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## CCCCLXVII.—VANILLAS OF COMMERCE.

An article on the cultivation and curing of Vanilla appeared, with a plate, in the *Kew Bulletin*, 1888, pp. 76–80. Other articles have appeared in the *Bulletin* in 1892, p. 212; 1893, p. 327, and 1894, pp. 206-208. The following historical and descriptive account of the species yielding aromatic fruits, more or less used in commerce, has been prepared by Mr. R. A. Rolfe, A.L.S., Assistant in the Kew Herbarium.

The principal species is *Vanilla planifolia*, Andr., a native of South-eastern Mexico, now widely cultivated in many tropical countries. *V. Pompona*, Schiede, yields the Vanilloes of Guadeloupe, while the allied *V. Gardneri*, Rolfe, is said to yield Brazilian or Bahia Vanilla. Both *V. appendiculata*, Rolfe, and *V. odorata*, Presl., produce aromatic fruits, but there is no evidence that either is cultivated at the present day for economic purposes. *V. phœantha* is under cultivation at Jamaica and Trinidad as a vanilla plant. The fruit has, however, very little perfume.

Mr. Rolfe has monographed the known species of the genus, 50 in number, and the result will be communicated to the Linnean Society. The descriptions of the species either known or likely to be of economic value have been extracted for the present paper. They bear the numbers attached to them in Mr. Rolfe's systematic enumeration :—

From historical accounts we learn that vanilla was used by the Aztecs of Mexico as an ingredient in the manufacture of chocolate prior to the discovery of America by the Spaniards, who adopted its use, and Morren states that it was brought to Europe as a perfume about the year 1510 at the same time as indigo, cochineal, and cacao, and ten years before the arrival of tobacco.

The earliest botanical notice of the vanilla is by Clusius, in his *Exoticorum Libri Decem*, published in 1605. This author had received fruits from Morgan, apothecary to Queen Elizabeth, in 1602, which he described as "Lobus oblongus aromaticus" (p. 72), without being aware of their native country or use. He describes them as 6 to 8 inches long by half an inch broad, and terete, from which it is evident that they belonged to the true Mexican *Vanilla* (*V. planifolia*).

In 1651 a figure was given by Hernandez in his *Nova Plantarum Mexicanorum Historia* (p. 38), under the name of *Araco aromatico*,

which shows both the characteristic growth and fruits of the plant, the flowers not being represented. The original of this figure was one of a series of 1200 executed at great cost in Mexico, by order of the King of Spain, during the previous century. Hernandez only mentions its use as a drug and gives its native name as "Tlilxochitl."

Piso in his *Mantissa Aromatica*, published in 1658, appears to have first put the name Vaynilla on record, and also its use as an ingredient in the manufacture of chocolate (pp. 200, 201). He describes it as the fragrant siliqua or pod of the *Araco aromatico* of Hernandez, and that it was called Vaynilla by the Spaniards, who added it to chocolate, not only on account of its fragrance but because of its medicinal virtues. The name is the diminutive of the Spanish *vaina*, a pod or capsule.

In 1675 Redi figured the pod and seeds, the latter as seen under the microscope (*Experimenta*, p. 179). He called it Vainiglias.

Dampier next furnished some important information about the plant. Speaking of the coast of the Bay of Campeachy, South Mexico, under date 1676, he remarks:—"Here are great plenty of Vinellos," (*Voyages*, II., pt. 2., p. 123). And at Boca-toro, in Costa Rica, which he visited in 1681, he observed:—"There grow on this coast Vinelloes in great quantity, with which Chocolate is perfumed" (I., p. 38). At a place called Caibooca in the former locality, Dampier remarks:—"We found a small Indian village, and in it a great quantity of Vinello's drying in the sun. The Vinello is a little Cod full of small black seeds; it is 4 or 5 inches long, about the bigness of the stem of a Tobacco leaf, and when dried much resembling it: so that our Privateers at first have often thrown them away when they took any, wondering why the Spaniards should lay up Tobacco stems. This Cod grows on a small Vine, which climbs about and supports itself by the neighbouring trees: it first bears a yellow Flower, from whence the Cod afterwards proceeds. It is first green, but when ripe it turns yellow; then the Indians (whose manufacture it is, and who sell it cheap to the Spaniards) gather it, and lay it in the sun, which makes it soft; then it changes to a Chestnut colour. Then they frequently press it between their fingers, which makes it flat. If the Indians do anything to them beside, I know not, but I have seen the Spaniards sleek them with Oyl" (I., p. 234). He further remarks that the Vines grow plentifully at Boca-toro, where he had gathered and tried to cure them but without success, and that he had never met with a Spaniard who could tell him, which led him to think that the Indians had some secret. "Could we have learnt the art of it, several of us would have gone to Bocca-toro yearly, at the dry season and cured them, and freighted our vessel. We there might have had Turtle enough for food and store of Vinello's . . . . They are commonly sold for 3 pence a Cod among the Spaniards in the West Indies, and are sold by the Druggist, for they are much used among Chocolate to perfume it. Some will use them among Tobacco, for it gives it a delicate scent. I never heard of any Vinello's but here in this Country, about Caibooca and at Bocca-toro" (I., p. 235).

The preceding accounts all clearly refer to the true Mexican *Vanilla* (*V. planifolia*), but in 1796 both Plukenet and Sloane introduce confusion into the records. The former includes the above under his "Vanillia's Piperis arbori Jamaicensis innascens" (*Almagest. Bot.*, p. 381), though figuring the true plant (t. 320, fig. 4). The latter, while retaining Clusius' original name, and citing the above references, records it as growing spontaneously in the woods of Jamaica about Aqua-alta (*Cat. Pl. Ins. Jam.*, p. 70). In his *Natural History of*

*Jamaica*, published in 1707, he further observes:—"It is said by several that they grow in this island about Aqua-alta, and that before the felling of timber and clearing ground, they were common in the shady bottoms of the inland parts of this island." (I., p. 180), so that it was evidently included on hearsay evidence, and probably the indigenous *V. inodora* (*V. anaromatica*, Griseb.) was mistaken for *V. planifolia*.

In 1703, Plumier briefly defined the genus *Vanilla* and three species from the West Indies (*Nov. Pl. Amer. Gen.*, p. 25), namely:—"V. flore viridi et albo, fructu nigrescente; V. flore albo, fructu breviori, corallino"; and "V. flore violaceo, fructu breviori, rubro." The first is figured at t. 28 (also later in his *Plantarum Americanarum*, II., p. 183, t. 188), and is certainly *V. inodora*. Of the second, a capital figure exists in his MSS. drawings, proving it to be *V. phæantha*. The third is a complete mystery, for while the other two are both figured and described in detail in his MSS. works, this is only mentioned in the following note:—"Reperitur alia species huic prorsus similis cujus tamen flores rubedine violacea splendent, fructu tandem breviores et rubri." This third species evidently does not belong to the genus. This was the first record of the flowers, but curiously enough no mention is made of the Mexican plant or its uses—merely the brief note that Vanilla is the name by which the plants are known to the Spaniards.

In 1705 Merian figured the fruiting branch of a Surinam species, calling it the greatest sort of Banille (*Metamorph. Insect. Surinam.*, t. 25). This is evidently *V. Pompona*, but in the text it is confounded with other species, as in previous records. A second sort, however, is said to grow in Surinam, which may have been *V. inodora*.

The Mexican Vanilla was, as already observed, introduced to England very early in the seventeenth century. The second volume of Miller's *Gardeners' Dictionary* appeared in 1739. There the author remarked that he had some branches of the plant, gathered by Mr. Robert Millar at Campeachy, and sent between papers by way of sample, and as the stems appeared fresh, though gathered at least four months, he planted them in small pots and plunged them in a hotbed of tanner's bark, where they soon put out leaves and roots. It is probable that they were soon afterwards lost.

Shortly afterwards Catesby gave a good coloured figure of *V. inodora*, including flowers and fruit, but in his remarks completely confounded it with the true economic plant.

Thus three distinct species had become confused together, and these are all included by Linnæus, in his *Species Plantarum*, in 1753, under the name of *Epidendrum Vanilla* (p. 952).

In 1775 Aublet published an account of the Vanilla (*Hist. Pl. Guian. Franç.* II., *Mem.* 4, pp. 77–85), remarking that in Cayenne there were three kinds of vanilla, known as Great Vanilla, Little Vanilla, and Long Vanilla. The first is *V. Pompona* and the last *V. inodora*, but the Little Vanilla is somewhat doubtful. He describes the pods as about 3 inches long by $1\frac{1}{2}$ thick. *V. phæantha* has not so stout a pod, and is not known from Guiana, otherwise it best agrees with the description. Although instructions for cultivating the plant and preparing the fruit are given, it is evident that Aublet knew very little of the different species, as he says that the fruits of all the three kinds are susceptible to the same treatment, acquire the same odour, more or less sweet, and may be put to the same use.

In 1799 Swartz re-established Plumier's genus *Vanilla*, enumerating two species, *V. aromatica* and *V claviculata* (*Nov. Act. Soc. Sc. Upsal.*, VI., p. 66). The former was based on *Epidendrum Vanilla*, L., and on Plumier's figure, which latter represents *V. inodora*, whose fruits are not aromatic, so that the name was evidently taken from the vanilla of commerce. *V. claviculata* is a leafless West Indian species.

In 1807, Salisbury figured and described a species of *Vanilla* under the name of *Myobroma fragrans* (*Paradisus Londinensis*, t. 82), which he stated to be the "*Vanilla flore albo fructu breviore corallino*" of Plumier, figured in that author's unpublished drawings, and to be certainly different from the vanilla of commerce (then supposed to be produced by *V. aromatica*). The species was said to be in several collections, but only to have flowered in that of the Right Hon. Charles Greville.

The following year Andrews figured and described this same plant, from the Right Hon. C. Greville's collection at Paddington, under the name of *Vanilla planifolia* (*Botanists' Repository*, VIII., t. 558). He cites the same synonym of Plumier as did Salisbury, yet most unaccountably states that the latter had confounded it with *V. aromatica*, Swartz, the fact being just the reverse, as has been shown above. The plant is said to have been introduced by the Marquis of Blandford.

Both authors, however, erred in identifying the plant with Plumier's, which is the short podded *V. phœantha*, Rchb. f. Although neither Salisbury nor Andrews mention the fruit, the flowers leave no doubt as to what was the plant they intended, and thus its Mexican origin is clear. Whether it came from there direct or was then cultivated in the West Indies is doubtful, but the interesting point is that these are the first representations of the flowers of the Vanilla of commerce, though the fact was not known until afterwards.

In 1811 Humboldt published an account of the Vanilla (*Voyage de Humboldt et Bonpland*, pt. 3. vol. II., p. 437), in which he remarked that he had observed pods of vanilla, of extraordinary size and very aromatic, in various parts of Venezuela, in the province of Jaen on the Upper Amazon in Peru, and in various parts of Guiana, but these probably belonged to *V. Pompona* and in some part to some allied and imperfectly known species. As regards the vanilla of commerce he gave some precise information, stating that the whole of it was obtained from the districts of Vera Cruz and Oaxaca, in Mexico. Here the plant abounded between the 19th and 20th parallels of latitude, and the fruits were collected by the natives, but the harvest was attended with some difficulty on account of the large area to be traversed, and they had already begun to propagate the plant, so as to have a larger quantity in a limited space. The wild vanilla or "Baynilla cimarona" gave a very dry fruit, and in small quantity, and was never planted. The natives of Misantla collected in the forests of Quilate the fruits of a vanilla, called "Baynilla de acguales," which was difficult to dry because of its large size and more watery nature. The plant flowered in February and March, and the cutting commenced in March and April, and continued until June. This may have been the *Vanilla Pompona*, which he afterwards mentions as having fruits very large and very good. At least six kinds of commercial Vanilla are mentioned, all but one apparently produced by *Vanilla planifolia*, the other by *V. Pompona*.

In 1825 Blume described *Vanilla viridiflora* (*Bijdr.*, p. 422) from a plant which flowered in the Botanic Garden at Buitenzorg, which had been introduced from America, and Prof. Charles Morren succeeded in tracing this back to the source whence Salisbury's and also Andrews's plant was derived (*Ann. Nat. Hist.*, ser. 1, III., p. 4). It appears that

M. Parmentier of Enghien obtained plants from the collection of the Right Hon. C. Greville in 1812, which were confided to the care of Dr. Sommé, the Director of the Botanic Garden at Antwerp. There it grew rapidly, "and slips were sent to all the towns of Belgium and France, but they very rarely flowered; once or twice in Flanders at the seat of Madame la Vicomtesse Vilain XIV., and at Liege; but fruit was never obtained." In 1819 Dr. Sommé sent two plants to M. Marchal for the Dutch colonies of Java, one of which the latter, by unremitting attention on the voyage, succeeded in saving, and gave to the Botanic Garden at Buitenzorg, being without doubt the one which Blume afterwards described. It, however, failed to fruit there.

In 1829 Dr. Schiede published four species of *Vanilla* which he met with in his travels in Mexico in 1820, under the names of *V. sativa*, *V. sylvestris*, *V. Pompona*, and *V. inodora* (*Linnæa*, IV., pp. 573–574). *V. sativa* he stated to be the "Baynilla mansa" of the Mexicans, and to have esulcate fruit. It grew spontaneously in the districts of Papantla, Misantla, Nautla, and Colipa, and was also sometimes cultivated. *V. sylvestris* was called "Baynilla cimarona," and had bisulcate fruit. It grew at Papantla, Nautla, and Colipa. *V. Pompona* was called "Baynilla Pompona," and had very large bisulcate fruit. It grew at Papantla and Colipa. *V. inodora* was called "Baynilla de puerco," and had bisulcate inodorous fruit. It was found at Misantla. He had not seen flowers of any of them. *V. sativa* and *sylvestris* he thought had probably hitherto been confounded under the name of *V. planifolia*, but as their difference in commerce was of importance he had given separate names, "although," he remarks, "the transitions have not escaped us." *V. sativa* was everywhere esteemed as the best, and was alone the subject of cultivation. Only at Papantla was *V. sylvestris* gathered beside it. A kind called "Baynilla mestiza" was nothing but a kind intermediate between the two, even in form as well as quality. *V. Pompona* was abundant in ethereal oil, and had an excellent scent, but did not admit of being dried in a sufficient degree to admit of its being sent to Europe, always keeping doughy, for which reason it was not an article of trade. *V. inodora* was perfectly useless, on account of the entire want of ethereal oil. A kind known as "Vanilla de mono" he had never seen. The vanilla villages were Papantla, Misantla, Colipa and Nautla, the first producing the greatest quantity, but being behind the others in that they collected a great deal of *V. sylvestris* and mixed *V. sativa* with it; also that they gathered them before they were perfectly ripe. The vanilla harvest commenced in December and continued on into March, being almost the exclusive employment of the Indians, who went out daily into the woods where the plants grew wild, or where they had plantations, taking their daily gatherings to the purchasers, who separated them according to their different kinds and qualities.

Between 1830 and 1838 Bauer and Lindley's *Illustrations of Orchidaceous Plants* appeared, and we find plates 10 and 11 of the *Genera* devoted to the structure of flowers and fruit of *Vanilla planifolia*, Andr., "drawn by Mr. Bauer in 1807." This is the first evidence of the production of fruit in Europe, and as the drawing was made in the same year as Salisbury's figure appeared, it is practically certain that it was made from the very same plant. How the flower became fertilised is not mentioned, perhaps accidentally or by some insect. Morren suggests that the fruit was drawn from a specimen of commerce, but the colour, the uniformly plump texture, and the fact that it is attached to the rachis, all show the contrary; quite apart from the fact that the vanilla of

commerce was then thought to be produced by another species, *V. aromatica*, which even Morren states that he sought for in vain in the gardens of London and its environs, and at Kew, and wrongly supposes it to be the plant cultivated by Miller in 1739. Morren is also wrong in stating that the "Vanilla planifolia (?)" of Lindley's Herbarium is "the very same plant drawn in flower by Mr. Francis Bauer," for it came from a Botanic Garden near Moscow, as the ticket "ex horto Gorenkensi" proves.

To Professor Charles Morren, of Liége, belongs the credit of first producing fruits in quantity, and of proving that *V. planifolia* was the source of the true vanilla of commerce. By a particular method of treatment adopted he succeeded in obtaining 54 flowers on one plant, and these he fertilised artificially, and obtained the same number of pods. The following year a crop of about 100 pods was obtained from another plant by the same method. His paper, "On the production of Vanilla in Europe," was read before the British Association at Newcastle, in 1838, and published in the following year (*Ann. Nat. Hist.*, ser. 1, III., pp. 1–9). He also succeeded in tracing his plant back to the one which originally flowered in the collection of the Right Hon. C. Greville, and also its introduction to Java, as has been already pointed out. Thus Morren first proved the necessity of artificial fertilisation, and he attributed its not bearing fruit in the East Indies to the absence of the species of insect which doubtless existed in Mexico, and there fertilised the flowers. He also suggested that vanilla might be produced in intertropical colonies, and also in European hothouses, by artificial fertilisation. Deltiel states that artificial fertilisation was first practised by Neumann, in 1830, in the Jardin des Plantes, but Morren makes no mention of it. In 1845 Blanco described a species of *Vanilla* from the Philippines, which he had received from his friend Azaola under the name of *V. majaijensis* (*Fl. Filip.*, ed. 2, p. 593), but it has since been referred to *V. planifolia*, and thus, if the determination is correct, it may have been at some time introduced from Mexico by the Spaniards. Blanco describes the pod as not aromatic, but it may not have been mature when he received it.

In 1872 M. Deltiel published an account of the cultivation of vanilla in Réunion, and showed that, although several different species had been introduced, the only one cultivated on account of its fruit was *V. planifolia*, which yielded the vanilla of commerce. In 1819 the Great Vanilla (evidently *V. Pompona*) was introduced from Cayenne, by Commandant Philibert, but was never an object of extended culture. A year later, a species was introduced from the Philippines by M. Perrotet, with a more slender and more aromatic fruit, but is said to have soon afterwards perished. Two years later M. Marchant obtained plants from Paris, and to this third introduction the present industry in Réunion owes its origin. Judging by the history of the vanilla grown on the Continent about this period it is pretty certain that the plants thus introduced from France were originally derived from the one in the collection of the Right Hon. C. Greville, whose history has already been given. The Philippine plant alluded to may have been the one described by Blanco, which has since been referred to *V. planifolia*. Deltiel records that the plants introduced into Réunion proved sterile until a slave named Edward Albius, about 1841 or 1842, discovered a simple and rapid method of fertilising the flowers artificially, which has been practised ever since. He also states that in Mexico and Guiana fertilisation is effected by small bees, belonging to several species of the genus *Melipone*, which visit the flowers for the honey they afford.

Mr. Morris states that the *Vanilla planifolia* is a native of British Honduras, and fine masses of it are found in the forest, hanging down from the trees, which, when the fruit is ripe, diffuses a fragrance perceptible at a considerable distance. The insect which fertilises the flowers is also present, as is proved by the number of bunches on the wild plants, which at present (1883) are allowed to rot on the vines and run to waste, though, if gathered and properly cured, a considerable trade might be made in them. (*British Honduras*, p. 81.)

25. **Vanilla planifolia**, *Andr.*, *Bot. Rep.*, VIII. (1808), t. 538.—A tall climber, with very long somewhat flexuose succulent green stems, and slender flexuose or twining white aerial roots opposite to the leaves. Leaves subsessile, oblong, acute or shortly acuminate, succulent, bright green, 4–9 in. long, 1½–2½ in. broad. Racemes axillary, 2–3 in. long, succulent. Bracts numerous, spirally arranged, oblong, subacute or obtuse, concave or conduplicate, 2–6 lin. long, gradually diminishing upwards. Pedicels 1½–2 in. long, green. Sepals and petals linear-oblong, subobtuse, 2 in. long, light glaucous green. Lip trumpet-shaped, a little shorter than the sepals and petals and of the same colour, united to the sides of the column to near its apex, and then convolute round it, apex three-lobed, mid lobe longer and retuse, margin revolute and denticulate, nerves carinate, and those in front densely crenulate-verruculose, buff yellow; disc with a tuft of retrorse hairs about the middle. Column clavate, 1⅛–1¼ in. long, hairy on the face. Capsule elongate-linear, obscurely trigonous, 6–9 in. long, 6–7 lin. broad.—*R. Br. in Ait. Hort. Kew*, ed. 2, V., p. 220; *Lodd. Bot. Cab.*, VIII., t. 733; *Bauer Ill. Orch., Gen.*, t. 10, 11; *Blume Rumphia*, I., p. 197, t. 68, fig. 2; *Lindl. Gen. & Sp. Orch.*, p. 435; *C. Morr. in Ann. Nat. Hist.*, ser. 1, III., p. 1; *De Vriese in Belg. Hort.*, VI., pp. 315, 365; *Bentl. & Trim. Medic. Pl.*, IV., t. 272 (*excl. syn.*); *Flück. & Hanb. Pharmacogr.*, p. 595; *Gard. Chron.*, 1867, p. 997; 1888, I., p. 562; *Bot. Mag.*, t. 7167; *Cogn. in Mart. Fl. Bras.*, III., pt. 4, p. 145.

*Habitat.*—South-eastern Mexico, in the Vera Cruz district, Misantla, Schiede! and Yucatan (Schott., n. 215!); also in British Honduras, Guatemala (Lehmann, n. 436!); and Costa Rica. Cultivated in the Mascarene Islands, Java, the West Indies, and other parts of the tropics.

Epidendrum Vanilla, *L. Sp. Pl.*, ed. 1., p. 952 (partim).

Vanilla mexicana, *Mill. Gard. Dict.*, ed. 8 (1761), n. 1 (partim).

Vanilla aromatica, *Sw. in Nov. Act. Upsal.*, VI. (1799) *et in Schrad. Journ.*, II., p. 208 (partim); *Lindl. Gen. & Sp. Orch.*, p. 434 (partim).

Vanilla Epidendrum, *Mirb. Hist. Pl.*, ed. 2, IX., p. 249 (partim).

Myobroma fragrans, *Salisb. Parad. Lond.*, t. 82.

Vanilla viridiflora, *Blume Bijdr.*, p. 422.

Vanilla sativa, *Schiede in Linnæa*, IV., p. 573; VI., p. 59; *Lindl. Gen. & Sp. Orch.*, p. 437.

Vanilla sylvestris, *Schiede in Linnæa*, VI., p. 573; VI., p. 59; *Lindl. Gen. & Sp. Orch.*, p. 437.

Vanilla majaijensis, *Blanco Fl. Filip.*, ed. 2, p. 593.

This species produces the true Mexican vanilla of commerce, which has been known ever since the discovery of America by the Spaniards, and which was described by Clusius as long ago as 1605 under the name of *Lobus oblongus aromaticus*. Its early history is much confused, as for a long period three or four species were confounded together, and even when the present one was described it was not known as the source of

the vanilla of commerce, which was then and for long afterwards thought to be *V. aromatica*, Sw. (*i.e.*, *V. inodora*, Schiede). It was introduced to cultivation about the year 1739, but was probably soon afterwards lost. The Marquis of Blandford re-introduced it about the beginning of the present century, and it flowered in the collection of the Right Hon. Charles Greville at Paddington in 1807, whence it can be directly traced to various Continental gardens, to Java, where Blume re-described it under the name of *V. viridiflora*, and to Réunion, thus originating the present industry in that island. *Myobroma fragrans*, Salisb., was drawn from the same individual as the original *Vanilla planifolia*, Andr. *V. sativa* and *V. sylvestris* of Schiede are chiefly known from the original descriptions, but are evidently forms of the same species, differing only a little in the length of the fruit, the former being a cultivated race, and the latter the wild original. *V. majaijensis*, Blanco, is also known only from description, and as the fruit is said to be not aromatic, a doubt remains as to its identity. Succeeding authors, however, have considered it synonymous with the present one, and if Blanco's fruits were unripe this view may be correct, in which case it seems probable that the species was introduced to the Philippines from Mexico by the Spaniards. Naves (*Blanco Fl. Filip*, ed. 3, Nov. App., p. 248) enumerates it as growing in the provinces of San Mateo, where he had seen flowers and fruit, and a confirmation of the identification seems desirable.

26. **Vanilla phæantha**, *Rchb. f. in Flora*, XLVIII. (1865), p. 274.—General habit of the preceding. Bracts fewer and larger, broadly elliptical-oblong, subobtuse, 3–7 lin. long, 2–4 lin. broad. Flowers larger, pedicels green ; sepals and petals $2\frac{1}{4}$–$2\frac{3}{4}$ in. long, greenish-yellow. Lip greenish-yellow, whitish in the throat, apex obscurely three-lobed and nearly truncate, nerves not carinate in front, disc with a pair of hairy lines extending from the central tuft of hairs towards the base. Capsule linear-oblong, obscurely compressed, 3 in. long, $\frac{1}{2}$ in. broad.

Vanilla planifolia, *Griseb. Fl. Brit. W. Ind.*, p. 638 in part, *non Andr.*

Vanilla planifolia, β. macrantha, *Griseb. Cat. Pl. Cub.*, p. 267.

*Habitat.*—West Indies, Cuba, *Wright*, n. 3351 (in part) ! St. Vincent, *Guilding !* in virgin forest between Mt. St. Andrews and the Grand Bonhomme at 2000 feet alt., *Smith !* Trinidad, *Hart !*.

This is an indigenous West Indian species, which has been confused with *Vanilla planifolia*, Andr., though it is easily distinguished by its much larger flowers, lip without verrucose disc, and its much shorter fruit. Mr. Hart states that it is indigenous in Trinidad, and that the fruit has little perfume, and Messrs. Smith remark that in St. Vincent they only observed it in a limited space but in virgin forest. It is cultivated in the Botanic Gardens of Jamaica and Trinidad, but there is no evidence of its fruits being of any commercial value. Wright's Cuban specimen at Kew, and also at the British Museum, is confounded with the leafless *V. barbellata*, Rchb. f., a fruiting specimen of each being attached to the same sheet, with a single ticket.

27. **Vanilla Pompona**, *Schiede in Linnæa*, IV. (1829), p. 573.—General habit of *V. planifolia*, but leaves larger, 6–11 in. long, $1\frac{1}{2}$–$4\frac{1}{2}$ in. broad. Bracts larger, broadly elliptical-oblong, 5–7 lin. long, 3–4 lin. broad. Flowers larger and rather more fleshy ; pedicels yellow-

green; sepals and petals 3–3½ in. long, greenish-yellow. Lip bright yellow, nerves somewhat thickened, central tuft consisting of descending imbricating scales rather than hairs. Capsule linear-oblong, strongly trigonous, 6–7 in. long, 1–1¼ in. broad.—*Lindl. Gen. and Sp. Orch.*, p. 437; *Klotzsch in Bot, Zeit.*, IV., p. 566; *Desv. in Ann. Sc. Nat.*, sér. 3, VI., p. 120; *Cogn. in Mart., Fl. Bras.*, III., pt. 4, p. 147.

Vanilla grandiflora, *Lindl. Gen. and Sp. Orch.* (1840), p. 435.

Vanilla guianensis, *Splitg. in Ann. Sc. Nat.*, sér. 2, XV. (1841), p. 279 (partim); *De Vriese in Tuinb. Fl.*, III., pp. 78, 81, t. 6 (partim); *Cogn. in Mart. Fl. Bras.*, III., pt. 4, p. 151 (partim).

Vanilla lutescens, *Moq. ex Dupuis in Rev. Hort.*, sér. 4, V. (1856), p. 121, fig. 24; *id. in Bull. Soc. Bot. de Fr.*, III., p. 354; *Duchartre in Journ. Soc. Imp. d'Hort.*, V., p. 97, t. 11; *Fl. des Serres*, XXI., t. 2218.

Vanilla surinamensis, *Rchb. f. in Nederl. Kruidk. Arch.*, IV. (1859), p. 321 (partim).

*Habitat.*—S.E. Mexico, Papantla and Colipa, *Schiede!* Valley of Cordova, *Bourgeau*, n. 2332! Nicaragua, Segovia, *Œrsted!* Panama, *Seemann*, n. 1159! Columbia, Lower mountains of Santa Martha, *Purdie!* Tolima, bei La Plata, 800–1500 m. alt.: *Lehmann*, n. 2263! Venezuela, at La Guayra; Trinidad; *Bradford*, n. 5285! *Hart!* British Guiana, Corentyne River, *Im Thurn*; Surinam, *Merian*; Cayenne, *Aublet.*—Cultivated in Martinique, Guadeloupe and possibly other localities.

This species is much more widely diffused than *Vanilla planifolia*, and its fruit has long been known as an article of commerce, being now usually sold under the name of West Indian Vanillons. It is the "Grosse Vanille" of Aublet, the "Baynilla de acguales" of Humboldt, and the "Baynilla Pompona" of Schiede. The pods are much thicker and more fleshy than those of *V. planifolia*, and more difficult to dry. They also fetch a much lower price in the market, but the fresh fruits are largely used in the same way as those of *V. planifolia*.

28. **Vanilla Gardneri**, *Rolfe;* caulibus crassiusculis, foliis subsessilibus oblongis obtusis crassiusculis, racemis crassiusculis brevibus, bracteis ovatis obtusis rigidis patentibus, sepalis petalisque linearilanceolatis subobtusis, labello oblongo subintegro obtuso submembranaceo nervo vix incrassato, disco subpubescente cristato, columna clavata, capsula ignota.

Vanilla planifolia, *Gardn. in Hook. Lond. Journ. of Bot.*, I., p. 542, *non Andr.; Travels in Brazil*, ed. 2, p. 225.

*Habitat.*—Brazil, in dry rocky bushy places, common, as on the Morra do Flamengo, near Rio, *Gardner*, n. 245! in moist places in the district of Parnagua, prov. Piauhy, *Gardner*, n. 2733! Natividade, prov. Goyaz, *Gardner*, n. 3449! Pernambuco, at Iguarassa; *Ridley*, *Lea and Ramage! Burchell* n. 894 from near Rio, and n. 9829 from San José da Laranjeira, Pará, may represent barren branches of the same. The latter is marked as "*Bahunilha*. Fructus teres, 4–5 poll."

*Folia* 3–5 poll. longa, 1¼–1½ poll. lata. *Racemi* 1½–3 poll. longi. *Bracteæ* 3–5 lin. longæ. *Pedicelli* ¾–1½ poll. longi. *Sepala* et *petala* 2¾ poll. longa. *Labellum* 2½ poll. longum. *Columna* 1½ poll. longa.

A species allied to *Vanilla Pompona*, Schiede, but with leaves about half the size, longer racemes with smaller not reflexed bracts, and rather smaller more membranaceous flowers. Gardner confounded it with *V. planifolia*, Andr., and remarked, "This is the plant which

yields the Vanilla (Banilha of the Brazilians) in Brazil," (*Hook. Lond. Journ. of Bot.*, I., p. 542) though unfortunately his specimens are without fruit. There are pods in the Kew Museum labelled "Brazilian or Bahia Vanilla," which are $5\frac{1}{2}$ inches long by fully 1 inch broad, fleshy, and distinctly triquetrous, and thus approaching those of *V. Pompona*, but with a rank odour. These are probably produced by the present species. "South American Vanilla" (*Kew Bulletin*, 1892, p. 214) may also have the same origin. They are described as from $6\frac{1}{2}$ to $7\frac{1}{2}$ inches long, quite broad and flattened, $\frac{1}{2}$ inch or more wide, reddish-brown, and the odour rank, somewhat resembling fermented molasses or rum. As much as 9000 lbs. of the beans are said to have been produced in 1891, and it is suggested that it is most likely used as an adulterant of the Mexican cut beans. Flowering and fruit specimens of the commercial plant are required to settle these doubtful points.

33. Vanilla appendiculata, *Rolfe;* caulibus crassiusculis, foliis breviter petiolatis oblongis v. elliptico-oblongis breviter et abrupte acuminatis subobtusis, racemis crassiusculis brevibus, bracteis oblongis obtusis, sepalis petalisque lanceolato-linearibus acutis labello oblongo subtrilobo, lobis lateralibus obtusis, intermedio anguste oblongo recurvo nervis appendicibus longis linearibus ornatis, disco medio appendicibus foliaceis cuneato-obovatis dentatis ornato, capsula angusta elongata.

*Habitat.*—British Guiana, Corentyne River, *E. F. im Thurn.!*

*Folia* $3\frac{1}{4}$–$4\frac{1}{2}$ poll. longa, 1–$1\frac{1}{2}$ poll. lata. *Racemi* 1–$1\frac{1}{2}$ poll. longi. *Bracteæ* 3–6 lin. longæ. *Sepala* et *petala* $2\frac{1}{4}$ poll. longa. *Labellum* 2 poll. longum. *Columna* $1\frac{1}{2}$ poll. longa. *Capsulæ* $4\frac{1}{2}$ poll. longæ.

Remarkable for its narrow sepals and petals, and long narrow lip which terminates in a narrow recurved apex covered with linear foliaceous appendages. The specimens were gathered in 1879, and both the fruits have opened, yet they retain a distinct aromatic perfume, though whether the species has any economic value is uncertain.

37. Vanilla odorata *Presl Rel. Haenk.* (1830), p. 101. Leaves shortly petiolate, linear-lanceolate, acute, 5–7 in. long., 6–8 lin. broad. Raceme short. Capsule sessile, linear-lanceolate, attenuate at apex and base, 6–7 in. long, aromatic.—*Klotzsch in Bot. Zeit.*, IV., p. 563.

*Habitat.*—Ecuador; Guayaquil, *Haenke.*

Only known from description. Presl remarks that although the fruits had been collected 36 years they still retained their aromatic fragrance.

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## CCCCLXVIII.—DISEASE OF PEPPER PLANTS IN MYSORE.

(*Piper nigrum*, L.)

The black pepper of commerce is the small pea-like fruit of a climbing plant, native of the East Indies, and cultivated in Southern India, the Malay peninsula, and the Eastern Archipelago. The skin or rind of the fruit is first red, and then dries of a black colour. White pepper is the ripe fruit deprived of its rind by maceration. There is no other difference between them. About 30 million pounds of pepper are

imported into the United Kingdom every year. An appeal has just been made to Kew by a pepper planter in Southern India respecting a disease which has broken out in Mysore. The disease, singularly enough, is closely allied to that causing serious damage to vines and orchard trees in Europe—*Dematophora necatrix*. It is hoped that the simple and effective means here suggested for the treatment of the disease will enable the pepper planters in Mysore to combat an enemy that threatens to seriously injure their industry :—

Mr. J. S. Middleton to Royal Gardens, Kew.

24, Augusta Road, Ramsgate,
27th July 1895.

Dear Sir,

I am very much interested in pepper-growing in Mysore, Southern India, but unfortunately a blight attacks the vines, very often as they are coming into bearing. It is not the pepper alone that is attacked, but even the saplings or undergrowth of the forest trees, which spring up very rapidly, suffer also. All over the plantation, at various points, this disease attacks these young saplings in patches of from 5 to 10 or 15 yards square, and I may say kills them off outright. This has led me to think it must be of a fungoid nature, though I cannot pretend to any scientific knowledge on the subject.

As regards the pepper vines, most are attacked at the roots, though some are attacked a few feet from the ground, and very soon afterwards the vine dries up, having infected most of the other vines in the neighbourhood. I have tried coal tar mixed with water, and paraffin oil also mixed with water, all to no purpose, but I have found great benefit from the application of fires, lighted in large numbers throughout the affected parts, though a great number of the young vines get scorched and die afterwards.

I have taken the liberty of sending a few specimens of diseased plants, and will be glad to come to you personally to give all the information I can, if you will kindly undertake to investigate the subject.

Believe me, &c.

(Signed) J. S. Middleton.

Diseased Pepper Plants from Mysore.

The disease is caused by an undescribed fungus closely allied to the one called *Dematophora necatrix*, which causes such damage in vineries and orchards in Europe by destroying the roots of the trees.

The material sent shows that the pepper fungus can reproduce itself by three different methods. (1.) The most general form, and the only one when the disease spreads from a centre, is by mycelium, or spawn, which travels in the soil, spreading from plant to plant, and destroying the roots.

When such centres of disease are noted, they should be at once isolated by digging a narrow trench about 10 inches deep round the diseased patch, thus preventing the outward spread of the mycelium, which cannot pass the trench.

As there is no cure for plants when the roots are attacked, it would be best to remove and burn all plants within the infected area, otherwise the diseased plants will form a centre of infection by another method.

(2.) If the stem of a plant that has been diseased at the root for some time is examined, very minute black lumps just visible to the naked eye will be seen scattered over the surface, and, in addition, small black, velvety patches are also very frequently present; these are two distinct fruiting conditions belonging to the fungus, each of which produces myriads of conidia or very minute reproductive bodies which are dispersed by wind and inoculate other plants. By this method plants become diseased above ground, the roots remaining healthy.

Nothing short of prompt destruction by burning of all plants showing such black lumps or velvety patches can prevent the spread of the disease by diffusion of the conidia.

As conidia are dispersed mostly by very low, earth currents of air, screens of branches might with advantage be erected between the plantation and the infected forest region.

The benefit derived from the fires to which allusion is made is explained by the fact that each fire forms a vortex through which a certain volume of spore-laden air passes, and is purified.

When the root form of the disease has shown itself, it is useless to plant again on the same spot before the soil has been thoroughly sterilized; lime, if available will effect this; wood ashes is also good for the purpose.

Finally, great care should be taken in the selection of perfectly healthy (that is, disease-free) portions of the plant for purposes of propagation. No portion of any plant showing the disease at any part should be used, for although portions of such plants may present no external indications of disease, yet, in all probability, the tissues of every portion contain mycelium which at a later stage will grow out and show the disease. In many parallel cases, where root disease is the trouble, the disease is in reality fostered by the planting of diseased cuttings.

G.M.

## CCCCLXIX.—DECADES KEWENSES.

PLANTARUM NOVARUM IN HERBARIO HORTI REGII CONSERVATARUM.

### DECADES XX. & XXI.

With a few exceptions, the plants of the two following decades are from the collection made by Mr. J. Theodore Bent on his second journey in Arabia Felix. Some particulars of the collection will be found at p. 158.

191. **Ionidium durum**, *Baker* [Violaceæ]; suffruticosum, ramulis lignosis albidis junioribus pubescentibus, foliis ad nodos fasciculatis obovatis integris vel obscure crenatis basi cuneatis sessilibus vel subsessilibus firmulis margine recurvatis utrinque viridibus obscure pubescentibus, stipulis deltoideis albidis integris persistentibus, floribus axillaribus solitariis breviter pedicellatis, sepalis ovatis viridibus albo-marginatis, petalis albis calyce 4–6 plo longioribus.

*Habitat.*—South-east Arabia: Dhofar Mountains at 2000 ft., *J. T. Bent*, 132.

*Folia* 2–3 lin. longa. *Sepala* ½ lin. longa. *Petala* 2½–3 lin. longa.

192. **Polygala dhofarica**, *Baker* [Polygalaceæ]; herbacea, perennis, glabra, caulibus brevibus ramosis, foliis lineari-oblongis obtusis subsessilibus firmulis utrinque viridibus junioribus pubescentibus adultis calvatis, floribus in racemis multifloris terminalibus dispositis axi pubescente, pedicellis brevibus, bracteis oblongis minutis deciduis, sepalis exterioribus parvis oblongis interioribus magnis orbicularibus albis venis multis viridibus anastomosantibus, petalis sepalis interioribus brevioribus, fructu obovato emarginato distincte alato sepalis interioribus æquilongo.

*Habitat.*—South-east Arabia: Dhofar Mountains at 300 ft., *J. T. Bent*, 186.

*Folia* 4 lin. longa. *Sepala* interiora cum *fructu* 2½ lin. longa.

Near *P. hohenackeriana*, F. & M.

193. **Fagonia nummularifolia**, *Baker* [Zygophylleæ]; fruticosa, ramosissima, caulibus lignosis viscoso-pubescentibus, foliis petiolatis orbicularibus crassis coriaceis planis utrinque viridibus viscoso-pubescentibus, floribus paucis solitariis axillaribus brevissime pedicellatis, sepalis oblongis viridibus viscoso-pubescentibus obscure cuspidatis, petalis obovatis rubellis calyce duplo longioribus, fructu late ovoideo carpellis pubescentibus dorso acute carinatis.

*Habitat.*—South-east Arabia: coast at Merbat, foot of Dhofar mountains, *J. T. Bent*, 68.

*Folia* inferiora 6 lin. longa et lata. *Sepala* 1½ lin. longa. *Petala* 3 lin. longa. Fructus 2 lin. diam.

194. **Cassia (Senna) oocarpa**, *Baker* [Leguminosæ]; fruticosa, ramulis dense pubescentibus, stipulis ovatis parvis, foliis petiolatis griseo-viridibus pubescentibus, foliolis 6–7-jugis oblongis obtusis emarginatis basi obliquis, floribus in racemis axillaribus breviter pedunculatis dispositis, bracteis orbicularibus caducis membranaceis viridibus, petalis orbicularibus vel obovatis parvis luteis venis brunneis, legumine breviter pedicellato oblongo subrecto plano pubescente.

*Habitat.*—South-east Arabia: coast at Merbat, foot of Dhofar mountains, *J. T. Bent*, 69.

*Folia* 4–5 poll. longa; foliola 12–15 lin. longa. *Petala*, 3 lin. longa. *Fructus* 12–18 lin. longus, 8–9 lin latus.

Near *C. holosericea*, Fresen., from which it differs by its shorter nearly straight pod.

195. **Dizygotheca Reginæ**, *Hemsl.* [Araliaceæ]; arbuscula paucipedalis in horto Kewensi florens, undique glaberrima, caule simplice robusto eximie lenticellato atque petiolis inflorescentiæ ramis plus minusve intense purpura colorato, foliis amplissimis longissime petiolatis digitatim multifoliolatis, foliolis 10–15 distincte petiolulatis coriaceis angustissime elongato-lanceolatis vel sublinearibus (in plantis junioribus foliolis paucioribus angustioribus minus distincte petiolulatis) integris undulatis apice obtusis basi cuneatis supra subnitidis subtus pallidioribus, costa utrinque elevata, venis primariis lateralibus numerosis, petiolo tereto basi apiceque incrassato patente vel deflexo deinde apice incurvo, inflorescentia terminali amplissima atropurpurea ramis primariis plurimis elongatis radiatim dispositis apice bis vel ter umbellatim ramosis, umbellis

ultimis nunc radiatis nunc sparsis, pedicellis distinctis, floribus flavo viridibus, calycis limbo brevissimo fere truncato, petalis subcarnosis lanceolatis apice breviter incurvis intus carinatis, antheris distincte quadriloculariibus, ovario quinqueloculari, fructu ignoto.—*Aralia Reginæ*, Hort. Lind., André in Ill. Hort. xxvi. p. 25, t. 337.

*Habitat.*—New Caledonia: discovered and introduced into Europe by Mr. Pancher for Mr. J. Linden.

*Caulis* prope apicem circiter 1 poll. diametro. *Folia* 1–1½ ped. diametro; petioli circiter pedales, medio 3–4 lin. diametro, basi 1 poll. diametro. *Foliola* 6–12 poll. longa, maxima 8–10 lin. lata; petioluli 4–12 lin. longi. *Inflorescentiæ* rami primarii umbellas compositas gerentes 6–8 poll. longi. *Umbellæ compositæ* 5–7 poll. diametro. *Pedicelli* 3–4 lin. longi.

196. **Pluchea mollis**, *Baker* [Compositæ]; fruticosa, ramulis dense albo-pilosis, foliis parvis sessilibus obovato-oblongis obtusis integris vel obscure crenatis penninerviis utrinque griseo-viridibus molliter pubescentibus, capitulis multifloris in corymbis densis terminalibus dispositis, pedunculis brevissimis dense molliter pubescentibus, involucro campanulato bracteis pauciseriatis adpressis pubescentibus exterioribus ovatis intimis linearibus, corollis cylindricis purpureis, achæniis minutis glabris cylindricis, pappo setoso albido flexili corolla æquilongo.

*Habitat.*—South-east Arabia: Hafa, Dhofar, *J. T. Bent*, 9.

*Folia* 6–12 lin. longa, 4–6 lin. lata. *Involucrum* 2 lin. longum. *Pappus* 2 lin. longus.

197. **Pluchea laxa**, *Baker* [Compositæ]; fruticosa, ramulis obscure pubescentibus, foliis sessilibus obovato-cuneatis obscure viridibus utrinque viridibus obscure pubescentibus inferioribus parce conspicue dentatis superioribus integris, capitulis multifloris in corymbis multifloris dispositis, pedunculis ascendentibus elongatis, involucri campanulati bracteis multiseriatis adpressis imbricatis intimis linearibus exterioribus lanceolatis, corollis cylindricis purpureis, achæniis minutis glabris, pappo albido setoso flexili corolla æquilongo.

*Habitat.*—South-east Arabia: coast at Merbat, foot of the Dhofar mountains, *J. T. Bent*, 7.

*Folia* ramorum 12–18 lin. longa. *Involucrum* 3 lin. longum. *Pappus* 2 lin. longus.

198. **Carduncellus kentrophylloides**, *Baker* [Compositæ]; suffruticosus, ramulis dense persistenter albo-incanis, foliis sessilibus oblongo-lanceolatis irregulariter spinoso-serratis utrinque albo-araneosis spinis stramineis, capitulis magnis multifloris solitariis terminalibus sessilibus, involucri campanulati bracteis exterioribus adpressis spinoso-pinnatis araneosis, intimis infra spinam terminalem truncatis, corollis purpureis, pappi setis elongatis plumosis flore æquilongis.

*Habitat.*—South-east Arabia: Dhofar mountains, at 2600 feet, *J. T. Bent*, 192.

*Folia* 12–18 lin. longa. *Capitula* 9–12 lin. diam. *Corolla* 6 lin. longa.

199. **Centaurea (Calcitrapa) dhofarica**, *Baker* (Compositæ); suffruticosa, ramulis pubescentibus, foliis oblongis obtusis basi crenatis

utrinque viridibus pubescentibus, inferioribus pinnatifidis lobis oblongis superioribus caulinis integris, capitulis solitariis terminalibus, involucri campanulati bracteis rigidulis stramineis basi ovatis adpressis spinâ terminali patula pungente basi utrinque spinulis 1–2 parvis appendiculata, floribus luteis, achæniis nitidis pallide stramineis, pappi setis permultis brunneis achænio æquilongis.

*Habitat.*—South-east Arabia: Hafa, Dhofar, *J. T. Bent*, 35.

*Folia* inferiora 2 poll. longa. *Spinæ* involucrales 9 lin. longæ. *Achænia* 1½ lin. longa.

200. **Rhododendron formosanum**, *Hemsl.* [Ericaceæ]; ramulis floriferis cito glabrescentibus crassis cinereis, foliis confertis distincte petiolatis primum lanato-tomentosis cito glabrescentibus crassis coriaceis suberectis anguste oblanceolatis elongatis obtusissimis deorsum longe attenuatis margine incrassato supra subnitidis minute reticulatis costa angustissima impressa subtus cinereis costa elevata, petiolo subterete angustissime canaliculato, cataphyllis arcte imbricatis inferioribus coriaceis brevibus rotundatis ciliolatis superioribus laxis elongatis tenuibus mollibus ferrugineo-pulverulentis, floribus mediocribus racemosis racemis terminalibus vel pseudoterminalibus 7–10 floris, pedicellis longis, calyce ferrugineo-puberulo brevissimo obscure late lobato, corolla intus extusque glabra breviter lateque lobata, lobo postico emarginato, staminibus 10 inclusis, filamentis infra medium incrassatis hirsutis, ovario furfuraceo 5-loculari, stylo glabro crasso stamina superante, capsula ignota.

*Habitat.*—Formosa: South Cape, *A. Henry*, 1976.

*Folia* 3–6 poll. longa, maxima 1 poll. lata, petioli 6–12 lin. longi. *Flores* circiter 1½ poll. longi et diametro. *Pedicelli* 1–1½ poll. longi. *Stylus* circiter 1½ poll. longus.

201. **Glossonema edule**, *N. E. Brown* [Asclepiadeæ]; herba ramosa incano-pubescens, ramis alternis furcatis, foliis petiolatis rotundatis rotundato-ovatis vel ellipticis obtusis apiculatis basi obtusissimis vel late cuneatis marginibus leviter crenulato-crispatis, umbellis ad nodos lateralibus sessilibus 7–8-floris, bracteis lineari-subulatis acutis rubescentibus, pedicellis subcrassis parce pubescentibus, sepalis attenuato-lanceolatis acutis pubescentibus, corolla campanulata infra medium 5-loba lobis ovato-oblongis obtusis leviter concavis dorso valde carinatis carinis validis obtusis parce pubescentibus ceteris glabris, corona a medio corollæ tubi enata tubulosa usque ad medium 5-loba lobis ovatis obtusis intus bicarinatis, columna staminum infra medium corollæ tubi enata brevi, antheris appendiculis reniformibus obtusissimis erectis styli apice crasso clavato multo brevioribus, folliculis junioribus ellipsoideis obtusis echinatis albo-tomentosis.

*Habitat.*—South-east Arabia: at the foot of Dhofar mountains, *J. T. Bent*, 175.

*Planta* 6 poll. alta. *Foliorum petioli* 1–2½ lin. longi, laminæ 5–10 lin. longæ, 4–10 lin. latæ. *Bracteæ* 1–1½ lin. longæ. *Pedicelli* 1 lin. longi, ½ lin. crassi. *Sepala* 1¼–1½ lin. longa, ½ lin. lata. *Corolla* 2 lin. longa, lobis 1½ lin. longis, ¾ lin. latis. *Corona* 1¼ lin. longa, lobis ¾ lin. longis latisque.

Allied to *G. varians*, Benth., but the flowers are smaller, the corolla lobes have not revolute margins, and the caudicles of the pollen-masses are very much longer than in *G. varians*. According to

a note on Mr. Bent's label, the flowers are green, and the plant is "eaten as salad." Probably the plant is a perennial with a tuberous rootstock.

202. **Trichodesma africanum**, *Baker* [Borragineæ]; perenne, humile, caulibus setis ascendentibus dense hispidis, foliis parvis oblongis obtusis sessilibus utrinque adpresse hispidis, floribus longe pedicellatis, sepalis floriferis cordato-ovatis cuspidatis foliaceis hispidis lobis basalibus rotundatis, corollæ limbo patulo lobis latis deltoideis haud cuspidatis, antheris dense albo-pubescentibus apicibus sterilibus productis leviter tortis.

*Habitat.*—South-east Arabia: Dhofar mountains, *J. T. Bent.*

*Folia* 6–9 lin. longa. *Sepala* florifera 6 lin. longa. *Corollæ* limbus expansus 6 lin. diam.

Near *T. indicum*, R. Br.

203. **Ipomœa (Strophipomœa) punctata**, *Baker* [Convolvulaceæ]; suffruticosa, late sarmentosa, caulibus pubescentibus, foliis longe petiolatis cordato-ovatis integris obtuse cuspidatis facie viridibus subcalvis dorso obscure pilosis nigro-punctatis, floribus solitariis axillaribus breviter pedunculatis, sepalis orbicularibus ciliatis valde imbricatis, corollæ tubo late infundibulari calyce 6–8-plo longiore, stylo corolla duplo breviore, staminibus brevibus.

*Habitat.*—South-east Arabia: Derbat, Dhofar mountains, *J. T. Bent*, 229.

*Folia* inferiora 6–7 poll. lata, petioli 4–5 pollicares. *Sepala* semipollicaria. *Corolla* $3\frac{1}{2}$ poll. longa.

A very showy plant, allied to *I. Lindleyi*, Choisy.

204. **Hyoscyamus flaccidus**, *Wright* [Solanaceæ]; herbaceus, humilis, caule brevi, foliis longe petiolatis rotundatis irregulariter angulato-dentatis basi cordatis marginibus petiolisque villosis, racemo paucifloro terminali, pedunculo pedicellisque villosis, calyce campanulato extus villoso lobis 5 triangulatis, corolla alba infundibulari obliquiter 5-lobata, staminibus 5 prope basin corollæ tubi affixis, antheris dorsifixis, ovario globoso biloculari, ovulis pluribus, stylo exserto, stigmate bilobo, capsula circumscissa calyce aucto cincta.

*Habitat.*—South-east Arabia: Dhofar mountains, Wadi Gergio, 1500 ft. *J. T. Bent.*

*Folia* 2 poll. diam.; *petiolus* $1\frac{1}{2}$–$2\frac{1}{2}$ poll. longus. *Racemus* 3–6 poll. longus. *Calyx* 4 lin. longus. *Corollæ* tubus 5 lin. longus, lobus maximus 2 lin. longus.

This approaches *H. leptocalix*, Stapf. ined., but differs in the shape of the leaves, more numerous flowers, and longer calyx tube.

205. **Orthosiphon comosum**, *Baker* [Labiatæ]; suffruticosum, ramis sursum albo-incanis, foliis subsessilibus oblongis obtusis irregulariter crenatis basi attenuatis utrinque viridibus obscure pubescentibus nigro-punctatis, racemis simplicibus terminalibus laxis, verticillastris bifloris, bracteis supremis erectis angustis coloratis persistentibus, pedicellis brevissimis albo-hirsutis, calycis tubo infundibulari pubescente dente supremo orbiculari haud decurrente dentibus inferioribus deltoideis, corollæ tubo infundibulari calyce duplo longiore labio supremo parvo oblongo inferiore

lato dentibus tribus parvis ovatis, staminibus longe exsertis, stylo apice furcato staminibus longiore.

*Habitat.*—South-east Arabia: Dhofar mountains at 2600 ft., *J. T. Bent*, 152.

*Folia* 1–1½ poll. longa. *Calyx* 2 lin. longus. *Corolla* 7–8 lin. longa. *Stamina* 15–18 lin. longa.

Near *O. stamineus*, Benth.; *Bot. Mag.* tab. 5833.

206. **Teucrium (Polium) nummularifolium**, *Baker* [Labiatæ]; perenne, ramosissimum, ramis dense persistenter albo-incanis, foliis subsessilibus vel brevissime petiolatis suborbcularibus vel inferioribus oblongis conspicue crenatis supra leviter subtus dense persistenter albo-incanis floriferis crebris reliquis conformibus, floribus breviter pedicellatis ad axillas foliorum superiorum solitariis, calycis tubo infundibulari dense piloso dentibus parvis lanceolatis, corollæ tubo calyci æquilongo labio superiore parvo orbiculari inferiore majore trilobato, staminibus labio inferiori subæquilongis.

*Habitat.*—South-east Arabia: Wady Gerzid, Dhofar mountains, *J. T. Bent*, 169.

*Folia* 3–4 lin. longa et lata. *Calyx* 2 lin. longus.

207. **Peperomia malaccensis**, *Ridley* [Piperaceæ]; succulenta, diffusa, prostrata, caulibus radicantibus obscure angulatis, foliis alternis ovatis cordatis obtusis petiolatis, petiolis obscure angulatis, laminis atroviridibus vel olivaceis, subtus argentatis, glabris (basibus minute pubescentibus exceptis), nervis 5 e sinu curvis, spicis singulis terminalibus pedunculatis viridibus glabris, floribus in rachi immersis dissitis, bracteis cuneatis apicibus oblongo-rotundatis, staminibus clavatis, ovario globoso haud rostrato, stigmate penicillato purpureo.

*Habitat.*—Malacca: on rocks in dense jungle woods, collected by *R. Derry*.

*Folia* 1½ poll. longa, 1 poll. lata, petioli ½ poll. longi. *Spicæ* 1½ poll longæ.

A curious and distinct species, remarkable for its ovate cordate leaves, which vary from dark green to coppery brown. It does not seem closely allied to any of the Indian or Malayan species, but resembles somewhat in habit *P. pachyphylla*, Miq., of the Sandwich Islands.

208. **Euphorbia (Rhizanthium) oblongicaulis**, *Baker* [Euphorbiaceæ]; radice fusiformi, caule tuberoso oblongo inermi cicatricibus foliorum delapsorum notato, foliis floribusque ad tuberis apicem dense rosulatis, foliis petiolatis lanceolatis vel oblongo-lanceolatis integris undulatis utrinque leviter albo-pubescentibus, pedunculis brevibus nudis strictis erectis simplicibus vel furcatis, involucro parvo campanulato viridi glandulis marginalibus orbicularibus integris viridulis, staminibus involucro paulo longioribus, coccis dorso rotundatis leviter pilosis, seminibus nigris glabris lævibus.

*Habitat.*—South-east Arabia: Rigout, Dhofar coast, *J. T. Bent*, 61, and gathered also by Lunt, on the Hadramaut expedition and brought alive to the Royal Gardens, where it flowered June 1894.

*Caulis* tuberosus 15–18 lin. longus, 6–9 lin. diam. *Folia* 1–2 poll. longa. *Involucrum* 1 lin. diam.

209. **Croton (Eucroton) confertus**, *Baker* [Euphorbiaceæ] ; fruticosus, foliis floribusque ad apices ramorum confertis foliis oblongis obtusis integris petiolatis facie pallide viridibus tenuiter albolepidotis dorso dense persistenter albo-tomentosis, floribus monoicis in racemis densis aggregatis, masculis lobis calycinis 5 ovatis basi coalitis dorso dense pilosis, petalis parvis oblanceolatis obtusis, receptaculo dense piloso, staminibus circiter 20 e calyce exsertis, femineis apetalis, fructu magno globoso dense persistenter stellato-piloso.

*Habitat.*—South-east Arabia : Derbat, Dhofar, *J. T. Bent*, 231.

*Caulis* 9–10-pedalis. *Folia* 12–15 lin. longa. *Stamina* 4 lin. longa. *Fructus* 7–8 lin. diam.

210. **Arthrostylidium Prestoëi**, *Munro* [Gramineæ-Bambuseæ] ; foliis brevibus angustis acutis subtus basin versus pubescentibus vaginis plerumque efimbriatis raro fimbriis 1–2 instructis, racemo simplice rachi cito articulatim secedente, spiculis 7–8 approximatis imbricatis subsessilibus compressis inferne glabris superne dorso et margine scabro-hirsutis. *Munro manuscript in Herb. Kew.*

*Habitat.*—Trinidad, *H. Prestoe.* There are also specimens in the Herbarium cultivated at Kew in 1879.

*Folia* 4–4½ poll. longa, et 6–7 lin. lata. *Racemi* circiter 1½ poll. longi.

This is very close to *A. Trinii* described in my memoir. It is, however, to be distinguished by having very few, not very numerous flowering branches, at the nodes; by having much longer and broader leaves, compressed not cylindrical spikelets prettily dotted with green ; by having the lower palea (flowering glume) of the fertile flowers scabrously hirsute on the upper half, not glabrus as in *A. Trinii*, and by having the two larger squamulæ usually obtuse, not acuminated. The ligule is also more conspicuous. *Munro manuscript in Herb. Kew.*

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## CCCCLXX.—BOTANICAL ENTERPRISE IN BRITISH CENTRAL AFRICA.

British Central Africa consists of a territory with a total area, north and south of the Zambesi, exceeding 500,000 square miles. The head-quarters of the Government is at Zomba, west of Lake Shirwa. The territory is under the administrative charge of Mr. H. H. Johnston, C.B., Her Majesty's Commissioner and Consul General. The following extracts are taken from a report, lately presented to the Commissioner by Mr. Alexander Whyte, head of the Scientific Department, and published by the Foreign Office (Miscellaneous Series, 1895, No. 373). Mr. Whyte gives an interesting account of the steps taken to establish a Botanic Garden at Zomba, and of the most promising plants grown there for use and ornament :—

I have been requested by Commissioner Johnston to draw up a report on what has already been done at Zomba in the foundation of a Botanical Garden, and what I propose to do in future towards encouraging agricultural enterprise in British Central Africa. I may state that it is also at the request of the authorities of the Royal

Botanical Gardens, Kew, that I have prepared this report, which I would respectfully request may be communicated to them.

On my arrival at Zomba in August 1891, my attention was first directed to choosing a sheltered spot of ground, about an acre in extent, on which to erect nursery sheds for rearing the many varieties of seeds which I had brought out with me. The clearing of the jungle, hoeing of the land, and the erection of thatched sheds was soon accomplished by natives (Yaos) from the neighbouring villages, and I was glad to find that really good honest work could be got from these people with just treatment and proper supervision. When they first mustered with their little circular short-handled home-made hoes I felt disposed to look with despair on the prospect of ever getting effective work done. I soon found, however, that they turned up the soil well, and when proper European implements were placed in their hands they proved to be as good native field labourers as any I had previously met with in other tropical countries.

Of the seeds sown in the nurseries all the European vegetables did well, with one or two exceptions, and a plentiful supply was kept up, which I have no doubt was greatly conducive to the health of the Europeans at the station. Hampers of vegetables were also occasionally sent to other stations of the administration.

The tree seeds also germinated well, and included species of *Cupressus*, *Eucalyptus*, *Acacia*, *Cassia*, *Ficus*, *Grevillea*, *Citrus*, *Thuja*, *Cedrus*, *Carica* (Papaw), &c.

The English potato tubers which I had brought with me were spoilt, I am sorry to say, in transit, owing to the extreme heat, but I am happy to state that the seeds of the potato I had with me turned out remarkably well. By constantly selecting and replanting the small tubers obtained from this seed we at last arrived at several large well-formed mealy varieties, equal in flavour to any English potato. These are now being carefully propagated by Mr. McClounie, the Forester temporarily in charge at the residency. This I look on as a most useful introduction, the potatoes showing no sign of disease, and being, as it were, natives of the country, they are not so liable to degenerate in quality hereafter as the offspring of the English tubers would have been.

During the short stay of Mr. Johnston's expedition at Zanzibar in June 1891, Captain Sclater and I visited Sir John Kirk's old garden, a short way out of town, which is now a station of the Universities' Mission. Through the kind courtesy of the lady missionaries I procured the seeds of a good many economic and ornamental plants from the garden, such as Liberian coffee, *Casuarina*, Cassias, Guavas, Anonas, Passifloras, mango, orange, cucurbitaceous plants, pineapple shoots, &c., and nearly all of them are now doing well at Zomba. I also brought with me a supply of ripe cacao pods from the same garden or plantation, which plant had been introduced years ago by Sir John Kirk. The seeds from these pods, I regret very much to say, failed to germinate.

### Wheat Growing.

The barley and oats from English seed did well, and yielded fair crops, but the wheat seed from England proved a failure. It germinated well, but grew in tufts like grass, and refused to throw up grain stalks. Later on, however, I received, through Captain Sclater, a bag of wheat seed from the missionaries at Tanganyika. This lot, being acclimatised seed (the original having been imported many years ago by the Arabs),

did well, and yielded at the rate of nine bushels per acre, without manure. I was able, from the grain thus secured, to distribute seed to several of the stations best suited for the growth of wheat, and also to a good many of the native chiefs who are raising it, on the understanding that the administration will purchase the produce for the use of its Sikh soldiers. Some of the European planters are also cultivating it, Messrs. Buchanan, at Blantyre, and Mr. Brown, at Mlanje, having had good success. It is to be hoped that this industry will annually increase until sufficient wheat is locally raised for the consumption of the European population. At the present time the missionaries on Tanganyika grow sufficient wheat for their own wants.

### Tree Planting.

As soon as I found the tree seedlings in the nurseries were sufficiently advanced to be planted out, I commenced forming avenues of them along the main roads of the plantation. On either side of the straight avenue leading from the steps of the terrace garden to the bottom of the grounds I planted out rows of *Cupressus macrocarpa*, *C. lawsoniana*, *C. sempervirens*, and *Widdringtonia Whytei*, alternating with each other. Along the south and east avenue, bananas, *Cupressus macrocarpa*, and *C. sempervirens* were put in alternately. The original main avenue was planted up with *Acacia decurrens*, *Acacia Melanoxylon*, *Eucalyptus* of different varieties, and *Grevillea robusta*. The cross avenue, bisecting the grounds, was lined with *Thuja orientalis* and *T. occidentalis*. I may here mention that all the trees in these avenues have done remarkably well, and at the date of my leaving, last April, they formed quite a pleasing feature in the grounds, and had grown to an average height of 5 feet in two and a half years from seed. This refers to the conifers only, some of the eucalypti having shot up to a height of 45 feet in the same period. . . . . An arboretum of interesting trees was also planted up at the east end of the terrace garden, and this we propose to extend down the sloping ground to the banks of the Mlungusi.

One plot of ground was devoted to the cultivation of handsome native plants, and another to that of economic ones, both indigenous and introduced.

### Grass Lawns.

The grass lawns form another very effective and pleasing feature in the grounds. These I formed of the roots of a small creeping dub grass,* some patches of which I found on Mr. Buchanan's plantation. It takes possession of the ground in a wonderfully short time, and stands out the dry season well. It forms an excellent and nutritious pasture grass, which is very much required where the common grasses of the country are so strong and rank. I shall do my best to establish this pasture on a large scale all over the grounds of the Residency, and the seeds of it will be regularly saved for distribution.

### Seeds from Ceylon and Natal.

Through the kind courtesy of Dr. Trimen, of the Ceylon Botanical Gardens, I received some packets of valuable tropical seeds. A good

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* Probably *Cynodon Dactylon*.

many of these failed to germinate, but some did well, among others the tree tomato.

Mr. Wood, of the Durban Botanical Gardens, when I called on him on my way home, was kind enough to put us up a large packet of seeds. These, however, I could not send on to British Central Africa, owing to the new coffee-leaf disease regulations, but they have been most useful in enabling me to make exchanges of seeds in England.

### Native Cedar.

The timber of the new Widdringtonia cedar (*Widdringtonia Whytei*) from Mount Mlanje has been proved to be of excellent quality, equal to the finest yellow pine, and easily worked. It has been largely used at the Residency, Zomba, and the greater part of the timber-work of the new roof of that building is composed of it. It is also commanding a ready sale at Blantyre and on the coffee estates. I need scarcely say that I shall do all I can to encourage the planting of it in the Shiré Highlands, as I feel convinced it will play a very important part in the future timber supply of the country. I shall see that seed is regularly collected from the Government forests on Mount Mlanje and nurseries of them kept up. Plants of *Widdringtonia* in the conifer avenues, at Zomba, are now 7 feet high in three years from seed, and show every prospect of doing well at that elevation, 3,000 feet.

### Prospects of Botanical Enterprise.

As regards what I propose doing in the future towards encouraging agricultural enterprise in Nyasaland, I would first of all touch on the choice of a suitable site for botanical and experimental gardens.

I do not think a better could be found than the one now opened up and being experimented with at the Residency, Zomba, which I have already described. My reasons for arriving at this conclusion are :—

1. The soil is good, it is well sheltered, and has a good exposure.
2. The rainfall averages that of other districts on the plateau, and it is artificially well watered by means of an excellent system of irrigation.
3. Both tropical and sub-tropical plants are reared with facility and grow rapidly.
4. It is central, being now within two and a half days of the Lower Shiré and three days of Lake Nyasa.
5. And lastly, but perhaps most important of all, it is a comparatively healthy station for an European Superintendent to live at.

In connexion with it, as an auxiliary garden, the fine sheltered fertile "Palm Stream Valley," eight miles distant from Zomba, on the Blantyre road, might be opened up. A perennial stream flows through this valley, along the banks of which fine specimens of the noble Raphia palm flourish luxuriantly. The land is good, and the little vale is exceptionally well sheltered by the surrounding wooded hills. I consider the lower river district should be studiously avoided, owing to the extreme heat, severe drought, and its unhealthiness as well as the great abundance of locusts and other insect pests.

## Economic Plants.

As to the particular economic plants which it is most desirable to introduce, and the produce of which would most probably become staple articles of export in the future, it will be well to state briefly what is now being done in the way of agricultural enterprise.

*Coffee* is the principal staple at present, and over 30 estates have opened up, and, for the most part, planted with the ordinary *C. arabica*. This will no doubt be the principal cultivation, so long as leaf disease can be kept out of the country. *C. liberica* is also established in the Shiré Highlands; over 100 plants were raised from the seed I brought from Zanzibar, and these are now in full bearing. The Messrs. Buchanan also had several trees of it previous to this. It is more suited for the lower-lying districts than for the hills. Mr. Buchanan is besides cultivating several other varieties of *C. arabica*, and has also introduced a small-berried native one called "Quilimane coffee." Shiré Highlands coffee sold in Mincing Lane the other day at from 4*l.* 16*s.* to 5*l.*,* and it has now become a speciality in the London market, where it is in great demand. The natives, in some instances, have been induced to cultivate coffee on their own account, and I have no doubt they will do so more and more as they become more and more intelligent and enterprising.

*Tobacco* has been extensively cultivated by the Messrs. Buchanan for some years, both at Blantyre and Zomba. They have now a large local sale for their cut tobaccos and cigars, which are excellent. They have also obtained remunerative prices for their leaf in the London market, much of which is available for "wrappers." Mr. Robert Buchanan, of this most enterprising firm, which has already done so much to develop the resources of Nyasaland, is now at home, and is busily engaged in the study of tobacco manufacture, and selecting coffee, sugar, and other machinery. The experience thus gained I feel sure will be of benefit, not only to the Messrs. Buchanan, but also to the country at large. There is unlimited scope for the cultivation of this promising product. In Ceylon and many other British possessions this industry has made no headway, owing to the expense of labour and the scarcity of suitable land. Here the one is perhaps the cheapest in the world, and the other almost boundless. The natives have grown tobacco for their own use for many years.

*Cane sugar* has been manufactured for years by Mr. Buchanan at Zomba for local consumption. The climate and soil of the Upper Shiré are, however, more suited for the cultivation of sugar. The Messrs. Buchanan have therefore decided to extend their operations on the river, near Fort Liwonde, where they have procured a suitable grant of land for the purpose. Sugar being so low in price, and likely to continue so, I fear an export trade in it could not be made to pay in British Central Africa, even were the railway completed. The sugar-cane being a thoroughly tropical plant matures sooner on the hot steamy banks on the Shiré than it does in the Shiré Highlands.

*Tea* of good varieties, Assam and China, has been introduced, but is not as yet cultivated to any extent. It grows luxuriantly, and ought to do well in some districts. Our long dry season would prevent its flushing so freely as it does in Ceylon or Assam, but against this we have to put the abnormally low price of labour at from 9*d.* to 1*s.* per lb.

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* Some samples commanded a price as high as 5*l.* 5*s.*—H. H. J.

I see no reason why it should not become a profitable cultivation. I shall do all I can to introduce seeds and plants of the very best teas procurable.

*Theobroma Cacao.*—I have great faith in this valuable product doing well in the Shiré Highlands, and in most of the plateau of Nyasaland . . . . . more especially along the banks of our rivers and in many of the sheltered valleys on the slopes of our mountain ranges. Suitable shade trees should be planted with it, such as *Erythrina*, pimento, and nutmegs.

*India-rubber* or *caoutchouc* is another most important article of commerce the production of which should be encouraged. For this we are most favourably situated both as to climate and soil, as also the variety of caoutchouc-yielding trees and creepers which are indigenous to the country. It is an industry which specially recommends itself to the natives, who are naturally fond of woodcraft, and do not place much value on time when working for themselves.

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## CCCCLXXI.—NEW ORCHIDS.—DECADE 14.

131. **Pleurothallis rotundifolia**, *Rolfe;* nana, foliis brevissime petiolatis orbiculari-obovatis minutissime trideuticulatis marginatis carnosis, scapis gracillimis circa 6–floris, bracteis basi tubulosis apice triangulari-ovatis acutis parvis, sepalo postico oblongo acuto concavo, lateralibus fere omnino connatis oblongis brevissime bidentatis, petalis spathulato-oblongis subobtusis, labello subrecurvo integro oblongo obtuso, columna clavata marginibus alatis apice acuta.

Hab.—Jamaica, *Morris.*

*Folia* 3-4 lin. longa, $2\frac{1}{2}$–$3\frac{1}{2}$ lin. lata; petiolus 1–2 lin. longus. *Scapi* $1\frac{3}{4}$ poll. longi. *Bracteæ* $\frac{1}{2}$ lin. longæ. *Pedicelli* 2 lin. longi. *Sepalum* posticum 2 lin. longum, lateralia $2\frac{1}{4}$ lin. longa. *Petala* $\frac{3}{4}$ lin. longa. *Labellum* $\frac{3}{4}$ lin. longum. *Columna* $\frac{1}{2}$ lin. longa.

An interesting little species sent to Kew in 1880 by the Assistant Director, Dr. Morris, at that time Director of the Public Gardens and Plantations, Jamaica. It belongs to the group *Apodæ Cæspitosæ*, and is allied to *P. unistriata*, Rolfe, differing in having leaves only half as long and nearly orbicular. The flowers are straw-coloured, with three light red-purple nerves on the dorsal sepal, and the mid-nerve of the petals and basal three-fourths of the lip also purple-red in colour. Among Jamaica species it comes nearest to *P. delicatula*, Lindl.

132 **Cœlogyne carinata**, *Rolfe;* pseudobulbis tetragono-ovoideis diphyllis, foliis subsessilibus elliptico-oblongis v. lanceolatis subacutis, scapis arcuatis, racemis flexuosis circa 6–8–floris, bracteis linearilanceolatis acutis deciduis, ovariis hexapteris, sepalis oblongis acutis acute carinatis concavis, petalis linearibus acutis, labello trilobo lobis lateralibus erectis angustis subobtusis intermedio ovato-oblongo obtuso subundulato, disco tricarinato carinis lateralibus crenulatis, columna clavata apice alata.

Hab.—New Guinea.

*Pseudobulbi* 1½–1¾ poll. longi, ¾–1 poll. lati. *Folia* 4–5 poll. longa, 1¼–1½ poll. lata. *Scapi* 4–8 poll. longi. *Bracteæ* 7–9 lin. longæ. *Pedicelli* 8–9 lin. longi. *Sepala* 11 lin. longa, 4 lin. lata. *Petala* 10 lin. longa. *Labellum* 9 lin longum. *Columna* 7 lin. longa.

Introduced by Messrs. F. Sander & Co., with whom it flowered in June of the present year. Allied to the New Hebridean *Cœlogyne lamellata*, Rolfe (*Kew Bulletin*, 1895, p. 36), but it has differently coloured flowers of about half the size. The sepals and petals are very light, almost whitish green, and the lip paler, with an orange-brown area on the basal half of the front lobe and apex of the side ones. The basal part of the lip is also lightly splashed with orange brown, and the column light green. Scapes produced from the young growths before the leaves are fully developed.

133. **Eulophia deflexa**, *Rolfe;* foliis lanceolato-lincaribus acutis, scapis elongatis simplicibus, bracteis ovato-lanceolatis acutis, sepalis patentibus lanceolato-oblongis acutis carinatis, petalis subdeflexis ovatis apiculatis v. subobtusis, labello trilobo lobis lateralibus oblongis obtusis intermedio orbiculari-ovato obtuso, disco trilamellato barbato, calcare oblongo, columna clavata.

Hab.—Natal, *Allison.*

*Folia* 6–16 poll. longa, 5–7 lin. lata. *Scapi* 2 ped. alti. *Bracteæ* 6–9 lin. longæ. *Pedicelli* 10–12 lin. longi. *Sepala* 10 lin. longa, 3–3½ lin. lata. *Petala* 10 lin. longa, 6 lin. lata. *Labellum* 9 lin. longum, 5 lin. latum. *Calcar* 2 lin. longum. *Columna* 3 lin. longa.

An ally of *E. barbata*, Spreng., from which it differs in its more robust habit and lax raceme of larger and differently coloured flowers. It was sent to Kew by Captain Allison in 1891, and flowered in June of the present year. The sepals are a peculiar shade of light purple-brown, and the petals and lip beautifully veined with lilac-purple on a much lighter ground. The lamellæ and fringes of the lip are yellowish-white. The petals incline forward over the lip; hence the name.

134. **Polystachya zambesiaca**, *Rolfe;* pseudobulbis ellipticis v. elliptico-oblongis subcompressis di-triphyllis, foliis oblongis v. lanceolato-oblongis subobtusis basi conduplicatis subtus glaucescentibus carinatis, scapis terminalibus pubescentibus 4–8-floris, bracteis latissime rhomboideo-ovatis acuminatis pubescentibus submembranaceis, sepalis triangulari-ovatis acutis lateralibus carinatis, petalis lineari-oblongis bidenticulatis postice canaliculatis incurvis, labello recurvo trilobo lobis lateralibus erectis rotundatis intermedio ovato obtuso canaliculato, callo late oblongo pubescente, columna brevissima.

Hab.—Tropical Africa: Upper Zambesi, *Buchanan.*

*Pseudobulbi* 5–9 lin. longi, 4 lin. lati. *Folia* 1¼–3¼ poll. longa, 3–7 lin. lata. *Scapi* 2–3 poll. longi. *Bracteæ* 2–3 lin. longæ. *Pedicelli* 4 lin. longi. *Sepala* 4–5 lin. longa. *Petala* 3 lin. longa. *Labellum* 3 lin. longum. *Columna* 1 lin. longa. *Mentum* 2 lin. longum.

A small plant with the general habit of *Polystachya lawrenceana*, Kränzl., from the same region, which is perhaps its nearest ally. It flowered with Mr. James O'Brien in May 1894, and at Kew a year later. The flowers are greenish-yellow, with a deep brown spot on the

foot of the column, and some light purple veining on the side lobes of the lip. The bracts are whitish.

135. **Batemania peruviana**, *Rolfe;* pseudobulbis oblongis tetragonis diphyllis, foliis late lanceolatis acutis submembranaceis subtus subglaucis racemis paucifloris, bracteis conduplicatis latissime ovatis obtusissimis, sepalo postico erecto elliptico-oblongo obtuso apiculato, lateralibus subpatentibus oblongis subobtusis basi subconduplicatis, petalis erectis elliptico-ovatis obtusis subapiculatis apice subreflexis, labello trilobo, lobis lateralibus erectis rotundato-oblongis denticulatis, intermedio obovato-oblongo apiculato apice recurvo, callo carnoso transverso apice denticulato infra medium labelli sito, columna clavata apice alata denticulata, mento obtuso.

Hab.—Peru.

*Pseudobulbi* 2¼ poll. longi, 1 poll. lati. *Folia* 8 poll. longa, 1¾ poll. lata. *Bracteæ* 6 lin. longæ. *Pedicelli* 10 lin. longi. *Sepalum* posticum 10 lin. longum, 6 lin. latum; lateralia 11 lin. longa, 4 lin. lata. *Petala* 10 lin. longa, 7 lin. lata. *Labellum* 9 lin. longum. *Columna* 9 lin. longa. *Mentum* 3 lin. longum.

Introduced by Messrs. F. Sander & Co, and flowered in their establishment in March last. The sepals and petals are brown with green tips and a few irregular narrow green lines below; the column and lip white with innumerable minute purple dots at the base, and an irregular purple stain at the base of the front lobe. It is the fourth known species of the genus, the others being *B. Colleyi*, Lindl., *B. armillata*, Rchb. f., and *B. Beaumontii*, Rchb. f. The two latter are wrongly referred to *Zygopetalum* in the *Genera Plantarum*, but agree in structure with the original *B. Colleyi* and with the present species.

136. **Maxillaria parva**, *Rolfe;* nana, pseudobulbis cæspitosis elliptico-oblongis subcompressis monophyllis, foliis sessilibus lineari-oblongis acutis carinatis, scapis brevissimis vaginis laxis imbricatis, bracteis ovatis acutis carinatis, sepalis suberectis oblongis apiculatis apice subrecurvis, petalis erectis oblongis acutis apice recurvis, labello late oblongo subtrilobo lobis lateralibus erectis puberulis intermedio latissime oblongo obtuso apice revoluto, callo carnoso obtusissimo nitido, columna clavata.

Hab.—Brazil.

*Pseudobulbi* 4–6 lin. longi, 3–4 lin. lati. *Folia* 1–1¼ poll. longa, 2½–4 lin. lata. *Scapi* 4 lin. longi. *Bracteæ* 4 lin. longæ. *Sepala* 5 lin. longa, 2½ lin. lata. *Petala* 4 lin. longa, 2 lin. lata. *Labellum* 4 lin. longum, 2½ lin. latum. *Columna* 3 lin. longa.

A dwarf species allied to *Maxillaria pumila*, Hook., which flowered in the collection of C. Ingram, Esq., Elstead House, Godalming, in May 1890, having been discovered in a clump of *Sophronitis grandiflora*, Lindl. It was presented to Kew, and has since flowered annually. It is allied to *M. pumila*, Hook. (*Bot. Mag.*, t. 3613), but has stouter pseudobulbs, longer leaves, and yellow instead of purple flowers, with a light reddish-brown anther-case.

137. **Luisia Cantharis**, *Rolfe;* caule elongato, foliis teretibus elongatis subobtusis rigidis basi tubuloso-vaginatis, racemis brevissimis paucifloris bracteis transverse oblongis truncatis, sepalo postico lineari-oblongo obtuso concavo lateralibus oblongis acutis subconduplicatis

acute carinatis carnosis, petalis linearibus oblongis planis, labello trilobo lobis lateralibus erectis rotundatis parvis intermedio elliptico brevissime bidentato, disco 5 carinato, columna brevissima.

Hab.—Shan States, Burma.

*Folia* 4–6 poll. longa, 2 lin. lata. *Bracteæ* 1 lin. longæ. *Pedicelli* 6 lin. longi. *Sepalum* posticum 8 lin. longum; lateralia 7 lin. longa. *Petala* 9 lin. longa. *Labellum* 6 lin. longum, $2\frac{1}{2}$ lin. latum. *Columna* $1\frac{1}{2}$ lin. longa.

A remarkable species, allied to *L. volucris*, Lindl. It was imported by Messrs. Hugh Low & Co., who flowered it in June of the present year. The lip is clasped on either side by the almost conduplicate lateral sepals, and resembles a beetle of the genus *Cantharis*, with corrugated dull purple elytra. The dorsal sepal is a little tinged with light purple near the margin, the rest, together with the petals, being whitish; the lateral sepals are light green, with a broad dull purple margin, and the lip is of the latter colour, with some white at the extreme base, and a yellowish-white sunken area at the apex. The tip of the lip is appressed to the stem, as in *L. volucris*, and the petals are deflexed on either side, as if to direct an insect to the pollinia.

138. **Angræcum stylosum**, *Rolfe;* subacaulis, foliis oblongis v. obovato-oblongis brevissime bilobis obtusis, racemis pendulis multifloris, bracteis spathaceis late orbiculari-ovatis obtusis sepalis petalisque lanceolato-oblongis breviter acuminatis v. apiculatis reflexis, labello lanceolato-oblongo apiculato reflexo apice concavo, calcare elongato arcuato, columna clavata subelongata crassiuscula.

Hab.—Madagascar.

*Folia* $3\frac{1}{2}$–$5\frac{1}{2}$ poll. longa, $1\frac{1}{4}$–$2\frac{1}{2}$ poll. lata. *Racemi* $1\frac{1}{4}$–2 ped. longi. *Bracteæ* 3–4 lin. longæ. *Pedicelli* $\frac{3}{4}$–1 poll. longi. *Sepala* 10–11 lin. longa. *Petala* 8–9 lin. longa. *Labellum* 8–9 lin. longum. *Calcar* 4–5 poll. longum. *Columna* 3 lin. longa.

A striking species introduced by Messrs. F. Sander & Co., with whom it first flowered in July 1893. It has the general habit of the African *A. apiculatum*, Hook., with flowers nearly twice as large, while its unusually large column is characteristic. The flowers are smaller than in *A. Ellisii*, Rchb. f., the segments narrower and more reflexed, and the colour white with the spur tinted with light brownish buff.

139. **Notylia brevis**, *Rolfe;* pseudobulbis subobsoletis, foliis oblongis obtusis basi conduplicatis, racemis brevibus multifloris, bracteis linearilanceolatis acutis, sepalis liberis lanceolato-oblongis subacutis concavis, petalis lanceolato-oblongis subacutis concavis, labello breviter unguiculato trulliformi-ovato acuto basi calloso-carinato, columna subclavata lævi.

Hab.—Andes of S. America.

*Folia* 4–$4\frac{1}{2}$ poll. longa, 16 lin. lata. *Racemi* $1\frac{1}{2}$ poll. longi. *Bracteæ* 1–$1\frac{1}{4}$ lin longæ. *Pedicelli* 1 lin. longi. *Sepala* et *petala* $1\frac{1}{4}$ lin. longa. *Labellum* $1\frac{1}{4}$ lin. longum, $\frac{3}{4}$ lin. latum. *Columna* 1 lin. longa.

Introduced by Mr. F. C. Lehmann, and flowered in the collection of Sir Trevor Lawrence, Bart., in March last. It is allied to *N. micrantha*,

Lindl., though it markedly differs from this and every other small flowered species in its very short racemes. The sepals are nearly white, the petals stained with yellow on the disc, and the lip white. The precise locality is not known.

140. **Pelexia saccata**, *Rolfe;* foliis petiolatis elliptico-ovatis subacutis variegatis, scapis erectis pubescentibus, racemis elongatis multifloris, bracteis lanceolatis acuminatis, ovario pubescente, sepalo postico lanceolato-oblongo subobtuso concavo, lateralibus lanceolato-linearibus acutis, petalis oblanceolatis subobtusis cum sepalo postico in galeam conniventibus, labello columnæ marginibus adnato ovato apice subobtuso reflexo basi in calcare saccato obtuso ovario fere omnino adnato extenso, columna clavata.

Hab.—Guatemala.

*Folia* 5–6 poll. longa, 2–2¼ poll. lata; petiolus 3-4 poll. longus. *Scapi* ¾–1¼ poll. longi; racemi 5–7 poll. longi. *Bracteæ* 8–12 lin. longæ. *Ovarium* 5–6 lin. longum. *Sepala* et *petala* 5 lin. longa. *Labellum* 4 lin. longum. *Calcar* 3 lin. longum. *Columna* 3 lin. longa.

Imported by Messrs. F. Sander & Co., and flowered in their establishment in May last. Near *P. maculata*, Rolfe (*Kew Bulletin*, 1893, p. 7), but is readily distinguished by its shorter flowers and shorter more sac-shaped spur. The leaves are light green marbled with small irregular olive-green blotches, and a darker irregular band along the midrib, which is light reddish purple underneath. The sepals are green, and the petals and lip whitish.

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## CCCCLXXII.—SIAM BENZOIN (continued).

A brief account was recently given in the *Kew Bulletin* (1895, pp. 154–155) of the source of Siam Benzoin. This was obtained from a report furnished to the Foreign Office by Mr. Walter R. D. Beckett, Vice-Consul at Bangkok.

As the result of independent inquiry made at the instance of Kew by the India Office, the following further information has been received. This was obtained through the Siamese Minister of the Interior at Bangkok. It affords, therefore, an account of Siam Benzoin from the purely native point of view. All the accounts agree in ascribing the region of the Benzoin trees to the left bank of the Mekong river, in what is now French territory. This is a tract of upland country east and north-east of the important town of Luang Prabang :—

India Office to Royal Gardens, Kew.

India Office, Whitehall, London, S.W.
30th July 1895.

Sir,

In continuation of previous correspondence, I am directed by the Secretary of State for India to forward herewith for your information a copy of a letter, and its enclosure, regarding the tree producing

Siam Benzoin. It is suggested that the memorandum on the Siam Benzoin may be found suitable for publication in the *Kew Bulletin*.

I am, &c.

(Signed) A. N. Wollaston.
Assistant Secretary,
Revenue and Statistics Department.

The Director,
Royal Gardens, Kew.

No. 606.—2 F.—7, dated Rangoon, the 30th May 1895.
From—The Revenue Secretary to the Chief Commissioner of Burma.
To—The Secretary to the Government of India, Revenue and Agricultural Department.

With reference to the correspondence concerning the steps taken with the view of identifying the plant or tree which produces the resin known as "Siam Benzoin," I am directed to submit, for the information of the Government of India, a copy of a memorandum regarding the tree that produces this resin, and on the Gum Benjamin industry in Siam, prepared in Bangkok under the orders of the Siamese Minister of the Interior, and forwarded to the Chief Commissioner by Mr. J. G. Scott in April 1894. . . . . .

Mr. Scott stated that the area in which the Gum Benjamin trees were found was said to be all on the left bank of the Mekong, and, therefore, in what is now French territory. . . . . .

Mr. Scott further remarked "the great Siam Benzoin tract is Hua Pan Htang, Ha Htang Hôk, the upland country east and north-east of Luang Prabang." . . . . . .

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Memorandum regarding the Tree that produces Resin, and on the Gum Benjamin Industry in Siam.

The Gum Benjamin tree is large and tall, and has a heart similar to that of the "teng rang" (a species of *Shorea*) and "phayom" (a kind of mahogany). In its general character and in the form of its leaves it resembles the "takieu" tree (a forest tree of hard wood used for making dug-out boats). The Gum Benjamin tree is propagated from the original fruit. This, when fallen and lying upon the ground, takes root and sprouts after the fashion of the "phayom" and "gang" trees. As regards the trunk of the Gum Benjamin tree, there is no one who uses it. Gum Benjamin trees are generally found on elevated ground, and do not like the plains country. They grow in isolated patches like the forests of "teng-rang" and teak. A forest patch of Gum Benjamin usually contains from 50 to 60 trees and upwards, and the tree is found generally in large numbers along the high hills in the extensive forest region of Slua Phan, Tangslok, and the borders of Müang Theng, in the province of Luang Prabang. It is rarely met with in other countries except those outside the provinces immediately contiguous to Siam. The Siamese Thai, Annamites, and Tongsoos, who have settled in the above-mentioned provinces, have worked out and traded in the Gum Benjamin from an early period for successive generations, and these are scattered amongst the neighbouring people as well as being frequently found in Siam also. The season for working the Gum Benjamin is from the eighth or ninth months (July and August) to the tenth and twelfth months (September and November), when the season ends.

Thenceforward is the period during which the Gum Benjamin is bought and sold. The Gum Benjamin is worked after the following methods. So many trees are notched so as to form a girdle round the stem. An interval of three months is allowed to elapse between the period of notching and that of picking the Gum Benjamin dammar, which wells out of the trunk and collects in the notches. By means of a sharpened stick or the point of a knife this is picked out, bark and all, and gathered at once in baskets. It is then sorted and divided into different classes, according to choice. Picking cannot commence before the interval of three months has elapsed, as the dammar that has trickled out into the notches would not have had time to harden. It would still be soft and sticky, and if picked at the time would become dirty, owing to the bark coming off with it; nor would it be of such value either, as, being sticky, it would cling to other things, and the full benefit would not be derived, such as would be the case if it were properly dry. For this reason, the Gum Benjamin must be left for three months after the notching, in order that all the gum possible may well out, and it may become dry and hard. Among the people above mentioned the picking and sale of Gum Benjamin is generally considered as one way of obtaining a livelihood, for the gum has a value, and is reckoned as a marketable commodity. And even if the people have no other occupation but selling Gum Benjamin, that by itself is sufficient as a means of livelihood. The period during which the Gum Benjamin is sold is not necessarily confined to the eighth or ninth months. The reason for selecting that season is because the people of those parts have many other things to do; for instance, they have to plough the fields and reap their rice harvest. In the eighth and ninth months their work on the paddy fields is finished, and they can therefore turn their attention to to Gum Benjamin. For this reason there is a special season. Their paddy fields are their first care, and then the Gum Benjamin trade. Those who have no business with ploughing paddy fields and planting rice can, if they wish, work continuously at Gum Benjamin at all seasons, and during every month of the year. The Gum Benjamin trade requires no very great outlay of capital. All the implements required are one large axe, a rice basket, and an open woven basket. If a person wishes to work alone without servants to assist him, he can do so; for in the first stages there is nothing much that requires to be lifted or carried. The only labour necessary would be when the Gum Benjamin is being picked and placed in baskets, and has to be carried to the temporary or permanent home of picker. The profits gained on any one particular occasion or another can hardly be gauged accurately. Those who work out much sell at a large profit, those who work out little sell at smaller profit. One catty (133⅓ lbs.) and upwards would be considered a large output. Picked Gum Benjamin is sorted into three classes. The best class, and that which fetches a high price, is called "slua," and is that which is sold in large lumps, and is not dirtied by the presence of bark. The second class is that left over from the first class, and is in somewhat smaller lumps than the latter, and has some, but not much, bark attached to it. This is inferior in quality to Class I., and is half the value. That is to say, if Class I. is sold at 75 ticals, Class II. would sell at 37½ ticals. The third class is that left over from Class II. This class has bark attached to it, is soiled with dust and dirt, and is in fine small pieces. It is called "mun," and is half the value of Class II. The price of Gum Benjamin as sold in the jungle districts where the gum is worked is as follows:—Class I.

One Chinese catty (66⅔ lbs.), 100 or about 75 ticals. Class II. Half the price of Class I. Class III. Half the price of Class II. The price in Bangkok is:—Class I. One Chinese catty, 260 ticals, as it has always been.

The Gum Benjamin trees that grow in the jungle districts referred to are not the subject of disputed ownership by one person more than another. Any one who wishes to work Gum Benjamin has merely to go into the jungle, search for and notch as many trees as he pleases, like people, for example, who go into the jungle to cut posts for their houses. Nor is there any tax or other emolument accruing to the country from either the trunk or the gum of the Gum Benjamin tree; nor is the Gum Benjamin trade one in the prosecution of which much thieving or fighting arises, whether it is because there are many people together at a time, or because, being in the jungle where there are fierce tigers, one man cannot steal along alone by himself, but is obliged to travel with parties, and so robbery and theft are rendered impossible, is uncertain. This gum is sweet-scented, and is much used in mixing either with medicines or scents of various kinds. For whichever of these purposes it is sold, it always fetches a high price like other valuable commodities, and for that reason Gum Benjamin is an article of commerce which merchants have bought and sold from time immemorial to the present day.

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## CCCCLXXIII.—MISCELLANEOUS NOTES.

In the *Kew Bulletin* for February last (p. 38), an account is given of a small collection of dried plants made by Mr. F. H. Smiles, a gentleman attached to the Royal Survey Department of Siam. Amongst them was a remarkable scitamineous plant, upon which a further note will be found below. Mr. Smiles returned to Siam in December last with the intention of making further botanical collections. We regret to learn from a letter communicated to us by a friend that "while up-country, near Korat Siam, he died of dysentery in May last." It was confidently anticipated that he would have added considerably to our knowledge of the rich flora of Upper Siam. For nearly a quarter of a century we have endeavoured to procure from thence seeds or plants of the celebrated tree yielding Siam Benzoin, but so far without success.

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**Botanical Magazine.**—All the figures in the July number were drawn from plants that flowered at Kew. *Senecio Hualtata* is a gigantic herbaceous plant, native of Chili and the Argentine Republic. It was raised from seeds presented by Mrs. Ayscoghe Floyer of Basingstoke, and collected by her daughter, Mrs. Glynne Williams, at Vipos, about 19 miles north of the city of Tucuman. *Pyrus cratægifolia* is an elegant shrub or small tree, a native of Northern Italy, and so much like a thorn in appearance that one would naturally take it for a *Cratægus*. *Aristolochia unguliifolia* is singular in a genus remarkable for the variety in shape and size of the perianth. It is a native of Borneo, and was sent to Kew by Mr. H. N. Ridley, Director of Gardens and Forests in the Straits Settlements. *Neuwiedia Griffithii*, from Malacca, is exceedingly interesting botanically as representing a small tribe of the Orchideæ, having free stamens. This was also collected and sent to Kew by Mr. H. N. Ridley. The last figure is of

*Rubus lasiostylus*, a very pretty Chinese species, and one of Dr. A. Henry's numerous discoveries and introductions.

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**Hooker's Icones Plantarum.**—The fourth and concluding part of the fourth volume of the fourth series—plates 2376 to 2400, has been published. *Mascarenhasia utilis* (Apocynaceæ), a native of Madagascar, is from the collection of the Rev. R. Baron, who states that it is one of the important plants from which india-rubber is obtained. *Mussændopsis beccariana*, is a Malayan tree allied to the American *Calycophyllum*. This is the second genus of this affinity recently figured in this work. The other is *Emmenopterys* (plate 1823), a native of China. Several interesting grasses are figured, among them *Cyathopus*, a new genus from Sikkim. *Didissandra longipes*, *Rhododendron Hancockii*, *Brandisia racemosa*, *Jasminum primulinum* and *Codonopsis convolvulacea* are Chinese plants, all of an ornamental character. They were collected in Eastern Yunnan by Mr. W. Hancock, F.L.S. From the Rev. R. B. Comins's last Solomon Islands' collection there are the curious *Tabernæmontana anguinea*, *Stemonurus megacarpus*, and *Oxymitra macrantha*, which were described in the *Bulletin* for June-July. *Argostemma concinnum* is a miniature one-flowered plant belonging to the Rubiaceæ, collected in Northern Siam by Mr. Smiles of the Royal Survey Department.

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**Hand-List of Ferns and Fern Allies.**—This hand-list was issued in April last. The following account is given in the Preface of the fern collections at Kew :—

The collections of ferns, whether tropical or temperate, is perhaps, next to that of palms, the most important feature of the cultivation under glass in the Royal Gardens.

A special interest attaches to it, because it has been used so much in the preparation of most of the books and papers dealing with ferns which have been published in this country during the last half century. The celebrated botanical artist, Francis Bauer, was resident draughtsman for 50 years (1790–1840) to the Royal Botanic Gardens at Kew, and the beautiful series of analytical drawings of ferns which he made were published by Sir William Hooker, after his death in 1842, with descriptive letter-press and additions, under the title of *Genera Filicum*. During the 25 years (1840–1865) for which Sir William Hooker was the director of the gardens his attention was specially concentrated on ferns. Under the title of *Species Filicum* he published an elaborate work in five volumes, in which all the known species of typical ferns are fully described, and their synonomy and geographical distribution worked out, with copious illustrations by Mr. Walter Fitch. Of this, the first volume appeared in 1846, and the last in 1864. He planned also a condensed hand-book of all the known ferns, to be called *Synopsis Filicum*, intended specially for the use of colonists and travellers. All the drawings for this had been made, but the letter-press was not far advanced when he died in the autumn of 1865. It was completed by Mr. J. G. Baker, F.R.S., now Keeper of the Herbarium, in 1868, and a second edition was brought out in 1874. Since that date many hundred new species have been discovered, and a volume of Hooker's *Icones Plantarum*, containing plates and descriptions of the more interesting of the novelties, was published in 1887. Mr. Baker has also published in the *Annals of Botany* (1891) a summary of new ferns discovered or described since 1874. The type specimens from

which most of the descriptions and plates contained in this series of books have been made are deposited in the Kew Herbarium.

The living collection in the garden owes its completeness very largely to the zeal and assiduity with which the veteran pteridologist, Mr. John Smith, curator of the Royal Gardens from 1841–63, watched over it for more than 40 years.

In his privately printed *Records of Kew* (pp. 322, 323) he gives the following particulars of its origin and development:—"In the year 1822 I found the collection of ferns at Kew extremely poor, especially as regards tropical species, very many of those introduced in previous years having been lost and very few new ones added. . . . The tender exotic species were more or less of them growing without any arrangement in different houses, and unnamed, their number amounting to about 40. In 1825 I arranged the tropical species in a group at the end of the then lean-to house . . . now included in the tropical fern house, the area they occupied being 6 ft. by 12 ft. These formed the nucleus of the now great collection. They were successively added to by importations of living plants, as also plants raised from spores obtained from herbarium specimens."

"The collection continued yearly to increase, and in 1846 [1845] I drew up a list of the collection, which was published in an appendix to the *Botanical Magazine*, for that year; the number then amounted to 400 [378] species. This in 1857 [1856] was followed by another list, entitled 'Catalogue of Cultivated Ferns,' in which 600 [504] species are enumerated."

The principal books published by Mr. Smith are his *Ferns, British, and Foreign*, issued in 1866, which contains a classified list of all the species then known in cultivation, full directions for the cultivation of ferns of the different climatic types and by far the most complete history of their gradual introduction which has ever appeared in print, and his *Historia Filicum*, issued in 1875, which contains woodcuts of 220 types and gives a full exposition of his views on fern classification.

In 1868 the last published list was prepared by Mr. J. G. Baker. It enumerates 802 species and varieties of ferns and 48 of fern allies.

The present list comprises 1116 species and varieties of ferns and 97 of fern allies; this is exclusive of British ferns, of which 586 varieties are in cultivation.

The collection falls into three great groups:—(i.) Tropical; (ii.) Temperate; and (iii.) Hardy Ferns.

The Tropical Ferns are cultivated in No. II. House.

The Temperate Ferns are cultivated in No. III.; the Filmy Ferns have a separate House (No. II. A.), constructed for the special treatment which they require. The fine collection of Temperate Tree Ferns is contained in the Temperate House.

The Hardy Ferns are arranged on and about a small rockery, $\frac{7}{E}$ of the Key Plan, and forming the south boundary of Lawn L.

The structural development of the buildings in which the collection is housed has kept pace with its growth. Their history may be given briefly.

The Tropical Fern House (No. II.) is a span-roofed house 129 feet long, 34 feet broad, and 15 feet high in the centre. It has a wide transept on the south side, 40 feet long, 33 feet wide, and 19 feet high.

In 1841 the site of this house was occupied by two lean-to houses used for miscellaneous collections of stove plants. They are enumerated in Dr. Lindley's Report to the Treasury (1838) as Nos. 2 and 3; the former stood to the west, and was 50 feet long; the length of the

other was 60 feet. It was in No. 2 that, as stated above, John Smith first arranged the nucleus of the collection of Tropical Ferns.

In 1843, No. 2 was doubled and made into a span house.

In 1845, No. 3 was entirely taken down, and a new span-roofed house erected in its place. It joined on to No. 2, which was kept at a somewhat lower temperature, but opened into it through a partition. The centre was filled up with slate shelf staging, and the sides with stone shelves. No. 2 was used as a stove for rare palms and large tropical ferns. No. 3 was at first occupied by the Woburn collection of orchids presented by Her Majesty the Queen; for this purpose it proved eventually unsuited. The orchids were gradually replaced by *Aroideæ* and ferns. Ultimately the latter obtained possession of the whole house. According to John Smith (Records, p. 334), "the centre of the house was a raised sloping rockery, amongst which the plants were growing in a natural state, forming fine bushy specimens."

A small house for tree ferns was built in 1861; this was connected with the principal house in 1868, and now forms the transept.

In 1879 the Tropical Fern House, which from the decay of the timbers had lapsed into an almost ruinous condition, was further severely damaged by the hail storm of August 3rd; 1,152 panes of glass in it were broken. It was subsequently put into a thorough state of repair, but the collections received considerable damage.

In 1887 the west end of the house was set back a few feet; the staging was partly re-arranged and the broad path through the transept was made.

The humid conditions necessary for the cultivation of tropical ferns are unfortunately not conducive to the preservation of the structures in which they are grown when they are built of wood. In 1889 it therefore again became necessary to renew the east wing of No. II. House. In order to secure greater durability it was decided to use iron for the principal framework, and wood only for the lights. The top ventilation was provided for by means of a lantern instead of by the older and more clumsy method of sliding sashes. At the same time the use of green glass in the reconstructed wing was abandoned. This was introduced at Kew in 1846 on the recommendation of the late Mr. Robert Hunt, F.R.S., who advocated its use on theoretical grounds which are now known to be mistaken. The resulting improvement in the growth of the plants, especially the species of *Adiantum* was very marked, and in 1892 a portion of the west wing was re-glazed with equally satisfactory results.

The temperate ferns are now collected in a house (No. III.), which was also built on the system of mixed iron and wood construction. It was erected in 1892 to take the place of a decayed and obsolete structure composed of two small greenhouses united together, Nos. 4 and 5 of Dr. Lindley's report. The former (the northern wing) was erected in 1803, and in 1840 contained New Holland and Cape plants; the latter, which was "remodelled" in 1825, was filled with succulents.

The reconstructed No. III. is a span-roofed house 60 feet long, 23 feet wide, and 13 feet high. It contains a broad central and two side stages, with paths on both sides.

The north wing of the former No. III. had been latterly devoted almost exclusively to filmy ferns after the Kew collection had been enriched by the gift of that formed by the late John Cooper Forster, which was presented to the Royal Gardens in 1888 by his widow.

The collection is now contained in the new Filmy Fern House (No. II. A.) erected on the north side of No. II. It is 50 feet long by 14 feet wide, with a central path and two cases running the full length of the house.

The hardy ferns occupy the rockery originally devoted to Alpine plants (before the construction of the Rock Garden in 1882), and it extends over part of the adjacent ground. A collection was established here in 1874, and the rockery itself was reconstructed in 1888.

The collection as a whole is now probably the richest in existence in garden forms of British species. This is due to the munificent bequest by W. C. Carbonell, Esq., of the extensive collection formed by him at Rhiw Castell, Usk, Monmouthshire. The whole was removed to Kew in 1887. It consisted of 4,261 specimens, many probably unique, besides some hundreds of seedlings.

The total number of well-marked species of ferns and the vascular Cryptogamia (fern allies) now mounts up to 3,500. Not more than one-third of these have been brought into cultivation, and Kew is always glad to receive any additions, if possible in the form of well-established plants; if not, in the shape of dry spores, which can be collected and sent very easily by post in small packets.

The following table, which shows the per-centage of the total number of ferns found in different parts of the world was drawn up by Mr. Baker in 1867; but he does not think that the discoveries of the last 20 years will have altered any of the figures materially :—

| | | |
|---|---|---|
| Arctic Zone | 1 | per cent. |
| Europe | 4 | ,, |
| Temperate Asia, including Himalayas | 18 | ,, |
| Temperate N. America | 5 | ,, |
| Temperate S. Africa | 7 | ,, |
| Australia and New Zealand | 9 | ,, |
| South temperate America | 5 | ,, |
| Tropical Africa | 15 | ,, |
| Tropical Asia | 39 | ,, |
| Tropical America | 42 | ,, |

The present hand list is divided into three parts :—

(i.) Ferns proper (pp. 13–133);
(ii.) Fern allies (pp. 135–143); and
(iii.) as an appendix, a list of garden forms of British species (pp. 145–183).

With regard to (i) ferns proper, the arrangement is alphabetical and synonyms have been only sparingly introduced, those included being chiefly such as are in use in gardens and which are here referred to the correct name in each case. It has not been thought necessary, therefore, to supply an index. Those who wish to pursue the study of fern-nomenclature further may fall back on Hooker and Baker's *Synopsis Filicum*, upon which the present hand list is substantially based.

The fern allies (ii) have also been grouped alphabetically. It has not been thought necessary for the present purpose to separate them according to a botanical classification.

The cultivated and feral varieties of British ferns (iii) have been enumerated in an appendix. Although the collection of them at Kew is very rich, they stand in a different position to the collection of recognised and well-determined species. Apart from their intrinsic beauty, which is often striking, they are of considerable scientific interest as showing the range of variation due to crossing and seminal reproduction. The amateurs and cultivators who have raised them have furnished them with Latin names, often cumbrous and fantastic, which have received no formal definition. Th cannot, therefore, be

fixed or quoted for any scientific purpose; they have in fact, the same relationship to the species from which they have originated as bedding pelargoniums bear to *Pelargonium zonale*, or as the drumhead and other cabbages to *Brassica oleracea*.

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**Guide to Museum II.**—An "Official Guide to the Museums of Economic Botany, No. II." has lately been issued. The building now known as No. II. Museum was the original starting point of the whole series of museums at Kew. The first guide to its contents was published by Sir William Hooker at his own cost in 1855. The foundation of the museum consisted of the director's private collections, some few objects already belonging to the garden, and some given by Mr. John Smith, whose son, Mr. Alexander Smith, received the appointment of Curator. In 1857 the collections illustrating the Dicotyledons and Gymnosperms were removed from No. II. to their present position in Museum No. I., opposite the Palm House. After that the collections illustrating Monocotyledons and the Cryptogams or flowerless plants were rearranged in Museum No. II. which was enlarged in 1881 by the addition of a small west wing. No. II. is at the northern end of the Herbaceous ground, three minutes' walk from No. I. The present guide is the first entirely devoted to Monocotyledons and Cryptogams. It contains notes on the Orchid, Ginger, Iris, Narcissus, and Lily orders and affords specially valuable information respecting the Palm order which furnishes the daily food, habitation and utensils of a large proportion of the human race. It deals with the economic productions of the *Gramineæ*, including all the cereals and the tropical bamboos. It discusses also the various uses of the Cryptogams, including the club-mosses, ferns, seaweeds and mushrooms. In order to render the Guide as comprehensive as possible references are given to articles on special subjects that have appeared from time to time in the *Kew Bulletin*.

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**Seeds of Juan Fernandez Plants.**—Kew is indebted to Mr. J. Söhrens, of the Santiago Botanic Garden, for a quantity of seed of the *chonta*, the only palm (*Juania australis*) inhabiting the island. It is peculiar to Juan Fernandez, and is now almost confined to inaccessible situations. In addition there are twenty packets of seeds of other kinds of plants from the same source.

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**Cyathea medullaris.**—An exceptionally tall specimen of this, the tallest of all the tree-ferns of New Zealand, has been for many years a striking feature in the Temperate house at Kew. It was presented by H.R.H. the late Prince Consort in 1856, and was then of considerable size, so that its age now would be something like 60 years. Early this year it showed symptoms of ill-health, and it finally collapsed at the end of June. Its stem was then 31 feet in length and a foot in diameter 3 feet from the ground. When in robust health it bore a head of about a dozen fronds, each from 12 to 15 feet long and about 6 feet broad. In the moist woods and ravines of New Zealand this species often attains a height of 60 feet; the caudex is slender, with a large conical base of hard root-fibres, closely matted together to the thickness of a yard or more. There are several handsome examples of this fern in the Temperate house still, one of which was presented to Kew by Lord Swansea in 1887 and is now about 20 feet high.

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**Juan Fernandez Sandal-wood.**—The verification of the existence of a true sandal-wood in Juan Fernandez is recorded in the *Bulletin* for 1894, p. 110; and the receipt of a specimen (p. 372) from Professor F. Philippi, who described it from very imperfect material. Thanks to Mr. Söhrens, Kew now possesses excellent dried specimens of this most interesting plant (*Santalum fernandezianum*) collected by the donor himself. It is intended to give a figure and some further particulars of it in an early number of *Hooker's Icones Plantarum*. The following is an extract from Mr. Söhrens's letter on this subject:—

"It may be interesting to you to know that, after many years' search, only one live tree of the sandal wood has been found; which was in flower in the middle of April. I am going again to the island next week to endeavour to obtain cuttings of the tree. The height of the tree to the first branch is 5·4 m. The nearly horizontal branches prevented my measuring the total height, which may be about 8 m.; circumference 1·5 m. at 0·5 m. from the ground."

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**Achilus siamensis.**—In the present volume of the *Bulletin*, p. 39, a description is given of a new scitamineous plant under the above name; and at p. 122, in the notes on the plants figured in *Hooker's Icones Plantarum* it is hinted that the flowers described and figured were abnormal. An examination of some specimens of Cambodian origin, communicated by the late Dr. H. Baillon, together with a re-examination of the materials upon which *Achilus* was founded, leave no doubt that such was the case, and that the plant in question, as suggested by Dr. Baillon, is a species of *Globba*, which is here re-named *Globba siamensis*, Hemsl. How far the figures in the *Icones Plantarum*, p. 2370, deviate from the normal condition of the plant can only be determined by a complete series of specimens. It is possible, howevee, that a part of the apparent abnormality is due to the imperfect and young condition of the flowers examined. Still, abnormalities exist. On this point Dr. Baillon wrote:—

"Nous avons beaucoup de cette plante. Sur bien des fleurs je vois non seulement le tube que vous figurez, mais encore une corolle tres grêle, à tube jaune fort tenu. Le labelle ne manque toujours. Seulement, il est très réduit en général."

With this he sends the specimens referred to above, including one perfect flower having a slender elongated corolla tube and the fully developed labellum and lateral staminodia of a normal *Globba*. Whether the Cambodian plant is specifically the same as the one from Siam is uncertain, but there are differences which can only be correctly appraised by comparison with perfect specimens of the latter.

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**Ferula alliacea.**—Mr. F. W. Burbidge, F.L.S., Curator of Trinity College Botanic Garden, Dublin, has presented specimens, photographs, and water-colour sketches representing a plant cultivated in that garden under the above name. So far as the very imperfect authentic specimen of *Ferula alliacea*, Boiss., in the Herbarium goes, it agrees with the cultivated plant; and Boissier's description of the foliage confirms the view that this is its correct name. It is true that there are discrepancies between the description of the fruit and what is actually found; but these may perhaps be accounted for by the fact that sections of the fruit present very different appearances at different ages, so different indeed that in the absence of direct confirmatory evidence one

might doubt their having been taken from a plant of the same genus. Should Mr. Burbidge succeed in obtaining quite ripe fruit, the plant will be fully illustrated in *Hooker's Icones Plantarum*. It is believed to be one of several species that yield the asafœtida of commerce.

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**Donn's Hortus Cantabrigiensis.**—Spencer G. Perceval, Esq., of Bristol, has presented a handsome copy of the sixth edition of this work, of which the first edition appeared in 1796, and the thirteenth and last in 1845. The first seven editions were edited by James Donn, and successive editions were edited by F. Pursh (the author of the *Flora Americæ Septentrionalis*), John Lindley, George Sinclair, and P. N. Don. The first edition is still wanting at Kew.

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**Nature-Printing of Plants.**—Since the note at p. 157 on Kniphof's *Herbarium Vivum* was published it has been possible to examine another copy of the work in question, and also Brükmann's letter, there referred to, on nature-printing; both in the library of the Botanical Department of the British Museum. It appears that Kniphof's work was issued with coloured figures; the *pict.* in Pritzel's description having been overlooked. With regard to the discoverer of the art of nature-printing, Brükmann (1733) states he remembered hearing that it was invented by Sherard and introduced from England into Germany in the preceding century. But a manuscript note in the copy of Brükmann's letter consulted, refers to Spiegel's *Isagoges in Rem Herbarium* (1606) where the process is described, so that neither of the Bushby Sherards could have been the inventor. In all probability a process of nature-printing was employed by amateurs years before any published work was issued.

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**Kew and the Colonies.**—The following speech was delivered by the Marquis of Ripon, K.G., late Secretary of State for the Colonies, at the Anniversary Dinner of the Linnean Society, on the 24th May last:—

"I have to thank you very heartily for the reception you have given to the toast and also to my name. Sir Hugh Low has said that I have long been a Fellow of this Society, and I am not quite sure that I am not one of the oldest Fellows of this Society, because I am pretty old in age myself, and I became a Fellow of the Linnean Society when I was a very juvenile youth indeed. I therefore suspect that there are perhaps not very many members of the Society who have been longer in it than myself. But that recalls to my recollection, sir, the fact that I have been for many years a most unworthy member; I have been dealing with other things than natural science, and especially entomology, of which I used to be extremely fond, and I have not been able to pay any attention practically to those scientific subjects which so much interested me in my youth, and I have been so long absent from the meetings of this Society as to be totally unknown to you in the capacity of a Fellow.

"But it has been a great pleasure to me that this toast has been proposed by Sir Hugh Low. He spoke in such singular, and I was going to say such misplaced, modesty of himself in proposing the toast, that you, who do not know so much about his career as I do, would be surprised to learn that he had been a most distinguished public servant.

During that career he has done most excellent work as an administrator. I also venture to think that he has considerably underrated his services to science.

"Now, with regard to the Colonies and to their connexion with science and with this Society, I may truly say that the members of this Society, particularly those who I believe are so numerous in it, and who give their special attention to botany, have done great service in many ways to the Colonies; and the importance of botanical science and all it can do to secure and promote prosperity in different regions has become, I am glad to say, much more recognised in public departments in these days than it used to be. Sir Hugh Low has spoken in most just terms of services which have been rendered to the Colonies, especially by Kew. I think my friend Mr. Thiselton Dyer will not contradict me when I say that he has more to do with the Colonial Office than with any other public department, and I was very glad to learn from him recently that he found the mode in which we transact our business in that department not unworthy of his praise. Great work has been done and is being done, mainly through the exertions of Mr. Thiselton Dyer and Mr. Morris and his assistants, to aid the Colonies in the introduction of new plants, and in the development and cultivation of those which naturally belong to them. In all directions this is the case to day. On the West Coast of Africa at the present moment it is being done. It is only, you may say, the commencement, but it is a commencement which is very satisfactory in its progress and in its results up to the present time, and which I hope may develope very largely in the future. Then, again, we all know that in the West Indies great work has been done by those men—men, most of them I ought to say, who have been sent out from Kew to those Colonies. In Jamaica there is the fruit cultivation, which has become every day more important, and which only requires the establishment of further lines of steamers between Jamaica and the United States to develope a still larger and more important trade. And again, almost all our natural products have been, through the agency of Kew, introduced in Jamaica. You, sir, have alluded to a matter upon which I do not want to dilate at the present moment—to our services in that part of the world in which you have been. I find that much goodwill has always existed among our friends in Kew; but we must bear in mind that one of the great works which has been undertaken by Kew is to educate the Colonies to recognise the nature of their various natural products, and the advantage of introducing new products. But when you come to introduce new products you encounter difficulties. There are cultivators of the old sort whose products are dying out, and whose particular industry is falling away; it is not very easy to induce those who are in that unfortunate condition to appreciate the labours of the man from Kew who comes down and introduces new plants into their Colony which they see are gradually ousting the old ones. But we must bear in mind that this work is done not only in the Colonies, properly so called, with which I am now connected, but also on a large scale in the great Dependency of which I once had the honour of being the head, in India. The great development in India of tea and cinchona has been of the most valuable kind. With regard to tea, look at India and Ceylon and see what has been done of late years. I have had some statistics placed before me which show that whereas, not much more than 10 years ago—possibly a little longer—the China tea was 66 per cent. of the whole tea consumed in the United Kingdom, it is now only 12 per cent., and its place has been taken by teas from India and

Ceylon (hear, hear), and that vast trade which has been so created has been due to the exertions of men of science, and of those who have gone forth from Kew for the purpose of developing and encouraging that cultivation. Take, again, the case of cinchona. My friend Sir Hugh Low and those who have been in those hot climates know there is nothing which preserves the health under trying circumstances more than that most blessed thing quinine. The development of the cinchona plant has been marvellously increased of late years. Not very long ago the cost of a small quantity of quinine was very considerable in India, and at all events, while it might be within the reach of the richer European there, it was altogether out of the reach of the native population. Now I understand that in Bengal, since I left India, you can get at any post-office five grains of quinine for less than a farthing. (Applause). I know my taste for quinine developed so much in those climates that I have not quite given it up since, and by its means I have kept the influenza at bay in these bad times. I feel, therefore, very grateful to those who have developed its cultivation.

"I had a curious proof the other day of the way in which plants of great value may be but little known to those who do not cultivate science, or are not engaged in those industries in which these plants are employed. I received a deputation from Leeds. Though most of you probably think only of Leeds as an important place for the production of cloth, yet there is a great leather trade in Leeds besides, and this deputation of leading men came to me to do what I could to help to increase the production of Gambier. They told me that they could not get on without it, that it was absolutely essential to their industry, and that it came shipped to them from Singapore. I believe the largest quantity is not grown in Singapore but from native states beyond. I am bound to say that until I had received this deputation, I had never heard of Gambier. I knew nothing about it. I had placed in my hands some most interesting reports of Mr. Ridley (whose name you have mentioned) about it, and I have written to the Governor of the place to see what can be done to increase the production and to improve the packing of the material in that country, and the transmission of it to this country. There is a proof, gentlemen, of the many various ways, some of which are very little known indeed to this country, in which botanical science especially may be of value to the populations of our various Colonies.

"I suppose, in spite of the Colonial development of other European countries which is going on so rapidly at the present time, that the British Empire will show a larger amount of various climates, of greater variety of flora and fauna, perhaps, than any other country in the world, and to say that is only to show how valuable a society of this kind must be, and how very unwise it would be for any man who has charge of the administration of our Colonies and of India, if he were not to endeavour to bring to bear for their benefit the vast discoveries of science to the utmost of his power (hear, hear). That I can assure gentlemen is my inclination. But you must remember that when the rupee will keep on going down, and when legislative assemblies will have crotchets, when they will say that the disease of the sugar-cane is a visitation of God, and ought to be taken away by the power that sent it, rather than by taking scientific means of getting rid of it, difficulties arise which are insurmountable by Colonial Secretaries. There were days when Colonial Secretaries were very powerful and despotic. I am bound to say they generally got the Colonies into hot water, and kept them there during their term of office, and when one man went out another

kind of hot water was introduced by the next man. But it is not so much the case now, and I hope there is a better understanding than there was; but if so, it comes from our having been much more careful and considerate in dealing with the Colonists and even with their prejudices. Therefore you should never be hard upon the unfortunate Colonial Secretary. All I can say is, that I shall endeavour in that office to discharge the proper duties of a Fellow of the Linnean Society, and I know that I shall receive from the Institution at Kew the most valuable assistance in that undertaking. (Applause.)"

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**Manila-hemp Plants.**—There are numerous varieties of *Musa textilis* yielding the Manila-hemp of commerce. The two better kinds are known in the Philippines as *lanoot betul* and *lanoot batang*. The stems of the latter are said to yield as much as one catty (about 1⅓ lbs.) per stem. Great stress is laid on the fact that Manila plants can only be successfully grown in virgin soil, in partial shade, and with a regular rainfall. A writer in the *British North Borneo Herald*, 1 February 1894, states that "Anything less than a well distributed rain-fall of four "or five inches per month will stop their growth . . . even in the "Philippines there are districts too dry for them." If placed under unsuitable conditions the plants are said to revert to a stunted form known as *lanoot grotee*, yielding a small quantity of fibre or hardly any fibre at all. The cultivation and preparation of Manila-hemp have been fully discussed in the *Kew Bulletin*, 1887, April, pp. 1–4, and 1894, pp. 289–291 (with plate). Recently an interesting article with illustrations showing how the fibre is prepared appeared in the *Bulletin* of the Colonial Museum at Haarlem for March, 1895. It is stated that all the fibre exported at present is prepared by hand. Machines have often been tried, but owing to the abundant and cheap labour supplied by the natives it has been found more advantageous to continue the hand-cleaning methods. The enormous development which has taken place of late years in the Manila-hemp industry may be gathered from the fact that while the exports were only 126,000 piculs in 1841, they had increased in 1893 to 1,283,000 piculs. Manila-hemp is regarded as the most valuable of the white rope fibres which include Sisal and Mauritius hemp, Phormium and Sansevieria. Manila-hemp, in fact, governs the market in these commodities. Hitherto Manila-hemp plants have not thriven on a large scale outside the Philippine Islands. The character of the Manila-hemp plants grown at Kew and distributed to the West Indies and tropical Africa gave hopes that it might be possible to obtain plants with a more robust habit and capable of yielding a larger quantity of fibre. An application was made with this view to Mr. William Stigand, Her Majesty's Consul at Manila, who was good enough to obtain and forward to Kew a case containing 47 suckers "from a well-known grower." These arrived in November last. They yielded a number of strong healthy plants which so far promise to do much better under cultivation than the previous plants. Of the new sort it is intended to distribute a few to all the botanical establishments in the West Indies and West Africa, where they will receive special attention.

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